VOL. XIII, No. 2 APRIL, 1948

PROCEEDINGS

OF THE

# HAWAIIAN ENTOMOLOGY SOCIETY

FOR THE YEAR 1947

HONOLULU, HAWAII

## OFFICERS FOR 1947

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| *Vice-President* | D. T. Fullaway |
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## MEMBERSHIP 1947

Alicata, J. E.
Balock, J. W.
Beller, Samuel
Bianchi, F. A.
Bishop, L. C.
Bonnet, D. D.
Bryan, E. H., Jr.
Callaghan, G. F.[1]
Callan, E. McC.[1]
Carpenter, G. D. H.[1]
Carter, Walter
Courtney, O. K.
Davis, C. J.[1]
Dennery, Edmond B.
Faxon, Richard[1]
Fullaway, D. T.
Hadden, F. C.
Hilts, H. C.
Holdaway, F. G.
Howard, L. O.[2]
Illingworth, J. F.[1]
Ito, K.
Jensen, D. D.
Joyce, Charles R.
Kartman, Leo
Keck, C. B.
Krauss, N. L. H.
Lewis, J. Guy
Look, Wm. C.
McBride, O. C.
Maehler, K. L.
Mainland, Gordon B.
Marlowe, R. H.
Marshall, Guy A. K.[2]
Matsuura, M.[1]
Mumford, E. P.[1]
Murakami, Kenneth
Nishida, Takiyuki
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Perkins, R. C. L.[2]
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Rosa, J. S.
Ross, Marshall
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Schmidt, Helen B.
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Stout, O. O.
Suehiro, Amy
Swezey, O. H.[2]
Tanada, Yoshinori
Timberlake, P. H.[1]
Tuthill, Leonard D.
Usinger, R. L.
Van Zwaluwenburg, R. H.
Weber, P. W.
Weinrich, Wm.
Williams, F. X.
Wirth, W. W.
Wolfenbarger, D. O.[1]
Zimmerman, E. C.

[1] Corresponding Member.

[2] Honorary Member.

All correspondence should be addressed to the Secretary, Hawaiian Entomological Society, 1527 Keeaumoku St., Honolulu 4, Hawaii, from whom copies of the Proceedings may be obtained.

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PROCEEDINGS
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# Hawaiian Entomological Society

VOL. XIII, No. 2 FOR THE YEAR 1947 APRIL, 1948

## JANUARY 13, 1947

The 493rd meeting was held at the H.S.P.A. Experiment Station on Monday, January 13, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Alicata, Balock, Beller, Bonnet, Bryan, Fullaway, Kartman, Keck, McBride, Maehler, Pemberton, Ritchie, Rosa, Sakimura, Swezey, Tanada, Van Zwaluwenburg, Weber, Williams and Zimmerman.

Mr. Edmond Dennery was elected to membership in the Society.

### NOTES AND EXHIBITIONS

*Mediterranean fruit fly hosts*—Mr. McBride reported on hosts of *Ceratitis capitata* (Wiedemann) as follows: Chayote fruits (*Sechium edule*) frequently show injury from oviposition punctures. However, egg and larval mortality is usually 100 per cent. On April 10, 1946, 4 puparia were reared from one chayote fruit, from which emerged 3 adult female *Ceratitis*.

During October 1942 more than 100 adults of *C. capitata* were reared from balsam apple (*Momordica balsamina*). The first flies were reared from balsam apple in 1940. In 1932 4 adult Mediterranean fruit flies were reared from passion fruit (*Passiflora foetida*) from Moanalua gardens.

*Lepidoptera attacking rose*—For Dr. Holdaway and himself, Mr. Tanada reported the following: On November 27 a heavy infestation of *Achaea janata* (Linn.) and *Anacamptodes fragilaria* (Grossbeck) was observed on roses growing in the Koko Head region, Oahu. The damage was mainly on young flush growth and on young buds. According to the grower, infestation occurs only during the winter months: December, January and February. The larvae of both species were collected and reared to adults on rose leaves.

Other lepidopterous insects feeding on rose were corn earworm, *Heliothis armigera* (Hübner), the Mexican leaf roller, *Amorbia emigratella* Busck, the beet army worm, *Laphygma exigua* (Hübner) and the garden looper, *Plusia chalcites* (Esper). Of these *A. emigratella* and *L. exigua* were reared to adult on rose leaves. The corn earworm feeds mainly on the young buds, ruining the resulting flowers; it feeds less frequently on the foliage. According to the grower grasshoppers also cause injury to the rose buds.

*Myiasis in children*—Dr. Bonnet reported two cases within the past month of finding living fly larvae in fecal specimens submitted to the Board of Health for parasitological examination. The maggots were small (2.5-3.0 mm.) and were evidently *Dacus* sp., as determined by comparison with known *Dacus* larvae. In the case of a four year old boy the larvae occurred on at least two separate occasions after eating semi-ripe and ripe guavas. The other case showed the presence of fly maggots on a single occasion with no recurrence; in this case no history of diet was available. There was no evidence of gastric or intestinal disturbance in either case, and both cases should be recorded as accidental myiasis of a non-harmful form.

*A eumenid new to Hawaii*—Dr. Williams spoke of seeing a specimen of *Eumenes pyriformis philippinensis* Bequaert in his garden on upper Keeaumoku St., Honolulu late in the morning of January 5; it was pausing at the flower heads of *Justicia*. This immigrant wasp was first taken by K. L. Maehler at Hickam Field, Oahu, October 17, 1946, but due to confusion as to its identity was omitted from the 1946 list of insects new to the Territory which appeared in the first issue of this volume of the Proceedings. Dr. Williams remarked that Mr. Pemberton had seen the related *Eumenes latreillei petiolaris* (Schulz) in his garden in the same neighborhood a short time previously.

*Forcypomyia ingrami* Carter—Several members commented on the annoying abundance of this ceratopogonid midge about lights in homes. This has occurred in years past at this same season.

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## FEBRUARY 10, 1947

The 494th meeting was held at the H.S.P.A. Experiment Station on Monday, February 10, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Alicata, Balock, Beller, Bianchi, Bonnet, Bryan, Fullaway, Kartman, Keck, Nishida, Pemberton, Rosa, Ross, Sakimura, Swezey, Tanada, Van Zwaluwenburg, Weber, Williams and Zimmerman.

*Visitor:* Ray H. Greenfield.

NOTES AND EXHIBITIONS

*Dacus dorsalis* Hendel—Messrs. Balock and Kartman reported an experiment in which two small pigs recently weaned were fed 100 *D. dorsalis* larvae each, by drenching. Fecal examinations 24 hours later produced 16 fly larvae in various stages of digestion; in most cases nothing but the larval skin remaining. Another examination 48 hours after feeding produced four additional larval skins. This experiment was suggested by Dr. Bonnet's report on recent cases of myiasis in humans by *Dacus* sp., reported at the previous meeting.

*Phytomyza spicata* Malloch—Mr. Van Zwaluwenburg reported that recently Mr. Rosa and he had found several instances of attack by this agromyzid leaf miner among sugarcane seedlings standing in the open on the H.S.P.A. Experiment Station grounds. Infestation was light, only 11 examples being found among several dozen flats containing hundreds of seedlings each. At least four different crosses were infested. Parasitism by eulophids was fairly heavy.

*Some mite synonymy*—Dr. Bonnet stated that in a recent paper (Journ. Parasitology, 32: 445-452, 1946) Fox has placed the rat mite, *Laelaps hawaiiensis* Ewing in synonymy under *Laelaps nuttalli* Hirst, and has transferred *Liponyssus bacoti* (Hirst) to *Bdellonyssus.*

*Eumerus marginatus* Grimshaw—Dr. Holdaway and Mr. Tanada reported that from lily bulbs growing in moist, puddly soil at Wahiawa, Oahu, they had reared this syrphid fly in some quantity. The material was more or less decomposed and in addition to the syrphids contained mites and maggots from which were reared two specimens of the ortalid fly *Euxesta quadrivittata* Macquart.

*Ectoparasites of mammals and poultry from Guam and Ponape*—Dr. Alicata presented the following: During July and August, 1946, he made collections of ectoparasites on various hosts as follows, Guam: the ticks, *Boophilus annulatus australis* (Fuller) and *Amblyomma cyprium* Neumann, on cattle; and the mite, *Megninia cubitalis* (Megnin), on chickens. Ponape: the tick, *B. annulatus australis,* on cattle; the lice, *Lipeurus caponis* (Linn.), *Menopon gallinae* (Linn.) and *Oxylipeurus angularis* (Peters), on chickens; the mites, *Pterolichus obtusus* Robin and *Megninia cubitalis,* on chickens, and *Laelaps echidninus* Berlese, on rats; and the flea, *Ctenocephalides felis* (Bouché), on dogs. The parasites were determined as follows: the fleas and the mites on rodents, by Mr. Pemberton; the lice, by C. F. W. Mueusebeck and E. W. Stafford; the poultry mites, by E. W. Baker; and the ticks, by C. N. Smith.

*Liriomyza pusilla* (Meigen)—Mr. Zimmerman reported rearing this agromyzid fly from mines in *Cleome* sp.; this appears to be a

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new host record. At the same time he reared two parasites from the material, one, identified by Mr. Fullaway as *Derostenus* sp.

*Rhipidius pectinicornis* Thunberg—Mr. Weber exhibited females of this rhipiphorid beetle, a parasite of *Blattella* roaches. One of the beetles was taken alive, and this is the first record of females having been found in Hawaii. This is the species previously reported as *Rhipidius* sp. (Proc. Hawaiian Ent. Soc., 12: 485, 1946) males of which were first taken at Ewa and Hickam Field, Oahu, June to August, 1945.

*Chelonus texanus* Cresson—Mr. Weber exhibited specimens of this braconid parasite of armyworms collected at the Mid Pacific Institute, Honolulu, on September 11, 1946. This is the first recovery of the species; it was introduced in 1942 and 1943 by Mr. Bianchi from Texas.

## MARCH 10, 1947

The 495th meeting was held at the H.S.P.A. Experiment Station on Monday, March 10, at 2:00 p.m., with Vice-President Fullaway in the chair.

*Members present:* Messrs. Balock, Bianchi, Bryan, Carter, Fullaway, Kartman, Nishida, Pemberton, Rosa, Sakimura, Swezey, Tanada, Van Zwaluwenburg, Weber, Williams and Zimmerman.

*Visitor:* Dr. Leonard D. Tuthill.

Dr. E. McC. Callan was elected a corresponding member of the Society. Dr. L. D. Tuthill was nominated for membership.

### NOTES AND EXHIBITIONS

*Trichophaga tapetzella* (Linn.)—Dr. Swezey exhibited four specimens of this tineid moth collected from a rug by Mr. Chock at Haiku, Maui, in February. This appears to be the first record of this species from the island of Maui.

*Pachodynerus nasidens* (Latreille)—Mr. Van Zwaluwenburg reported the taking of this vespid wasp on Canton Island, a new island record; identification was made by Dr. Williams. J. P. Martin collected a female during a brief stop-over on Canton, December 30, 1946. This species occurs also on Guam as well as in the Hawaiian Islands.

*Dacus dorsalis* Hendel—Mr. Van Zwaluwenburg reported breeding this fruit fly from fruits of the white sapote (*Casimiroa edulis*) brought in by E. L. Caum in February. This is a new host record for this insect. Also reared from the sapote were adults of the anthomyiid fly, *Atherigona excisa trilineata* Stein, a general scavenger. Mr. Bryan spoke of finding green bananas stung by *D. dorsalis* in the field, and reported that this fly apparently oviposits in oranges and bananas in stores. Mr. Fullaway exhibited speci-

mens of Philippine braconid wasps parasitic on *D. dorsalis,* and stated that *Opius persulcatus* Silvestri is being bred in the laboratory. Mr. Pemberton reported that *D. dorsalis* was taken on Lanai in February by Dr. Kenneth Kopff; this is a new island record for the species.

*Hippodamia 5-signata punctulata* LeConte—Dr. Williams exhibited a specimen of this coccinellid beetle which occurs in California, which he had taken on a window in a Beretania St. vegetable store in Honolulu on February 25. The beetle lived for two weeks but laid no eggs. This, or a related ladybeetle, has arrived here before, for on January 10, 1947, Dr. Swezey found one on celery from California.

*Tachysphex bituberculatus Cameron*—Mr. Weber reported the capture of this larrid wasp new to the Territory, and distinct from the North American *T. fusus* Fox previously known here. A female of the new wasp was first taken by Mr. Weber in Honolulu, September 11, 1946, and a second specimen, a male, was captured at the H.S.P.A. Experiment Station, Honolulu, February 17, 1947. Determination of the local specimens was made by Dr. Williams after comparison with Philippine *bituberculatus* identified by the British Museum.

*Thrips damaging orchids*—Mr. Bianchi spoke of *Thrips* sp. damaging *Cattleya* orchids by ovipositing in the flowers.

*Plagithmysus newelli* Sharp—Mr. Maehler presented the following notes on this cerambycid beetle. The species was described by Sharp (Ent. Mon. Mag., 7: 240, 1896) from a unique specimen collected by Brother Newell at Wailuku, Maui in 1894. It was taken again in 1913 by W. M. Giffard who captured a single female in Awahi forest on Haleakala, Maui at 4000 ft. (Proc. Haw. Ent. Soc., 6: 478, 1927). However, as late as 1932 Dr. Swezey listed it as one of the species of *Plagithmysus* of which there was no host record (Proc. Haw. Ent. Soc., 8: 129, 135, 1932).

On March 5, 1947, while collecting on the slopes of Haleakala at 3000 ft., a single adult specimen was taken by Mr. Maehler which was later identified by Mr. Zimmerman as *P. newelli.* The specimen was collected in the living wood of *Nicotiana glauca,* having recently emerged from its pupal shell. Further search failed to reveal additional adults, but several larvae were found. The tree tobacco showed evidence of larval work up and down the stems. Of 20 trees examined, about half of them showed evidence of attack. This instance of an indigenous insect attacking an immigrant plant, and a living one at that, does not preclude the probability that it has another host, likely to be native, and perhaps one of the *Solanums.*

*Achaea janata* (Linn.)—Mr. Fullaway reported finding the larva of this moth feeding on foliage of false kamani (*Terminalia catappa*) on windward Oahu.

## APRIL 14, 1947

The 496th meeting was held at the H.S.P.A. Experiment Station on Monday, April 14, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Alicata, Balock, Beller, Bonnet, Courtney, Fullaway, Kartman, Keck, Krauss, Lewis, Maehler, Nishida, Pemberton, Rosa, Ritchie, Sakimura, Swezey, Tanada, Tuthill, Van Zwaluwenburg, Weber, Williams and Zimmerman.

Dr. L. D. Tuthill was elected to membership in the Society.

### NOTES AND EXHIBITIONS

*Psyllid note*—Dr. Tuthill reported that a single specimen of the genus *Aphalara* (Psyllidae: Homoptera) was taken on a ridge overlooking Nuuanu Valley, Oahu, on March 30, 1947. The species is *A. rumicis* Mally; the genus has not previously been known in Hawaii.

*Myelois venipars* Dyar—Dr. Swezey exhibited a specimen of this phycitid moth reared from a caterpillar found feeding in a navel orange from a Honolulu fruit store by S. M. Tutton on March 13. An account of the occurrence of this moth in Arizona is given by Glick (14th Ann. Rept. Arizona Comm. of Agr. and Hort.: 78-97, pls. vii-xi, 1922). It is called the Arizona navel orange worm. The caterpillars are found chiefly associated with oranges infected with black rot (*Alternaria citri*), and its occurrence is considered to be secondary. The orange from which the specimen was obtained was infected with black rot.

*Hyperaspis silvestrii* Weise—Dr. Swezey exhibited a specimen of this ladybird beetle reared from an infestation of *Pseudococcus pseudonipae* (Cockerell) on palm (*Chrysalidocarpus lutescens*) at his residence in Manoa Valley, Honolulu, April 5, 1947. Several of the white coccinellid larvae, resembling mealybugs, were present and evidently had the infestation well controlled. This ladybird was introduced from Mexico in 1922 as an enemy of *Pseudococcus nipae* (Maskell). It has been scarce since the disappearance of *nipae*, which was mainly due to the parasite *Pseudaphycus utilis* Timberlake, introduced from Mexico at the same time.

*Elaphria nucicolora* (Guenée)—Dr. Swezey reported finding a specimen of this new immigrant agrotid moth among a collection taken at light by Mr. Maehler in March 1947 at Kula, Maui. It is apparently the first record for this moth from that island.

*Ethmia colonella* Walsingham—Dr. Swezey reported on caterpillars of the kou moth collected on kou (*Cordia subcordata*) at Kohala, Hawaii in March 1947 by Mr. Marvin and given to him by Mr. Fullaway. It apparently is the first record of the occurrence

of the moth in that part of the island of Hawaii; it was reported last year from the Kona coast of that island.

New hosts of *Dacus dorsalis* Hendel—Mr. Keck reported the following new host records for this newly established fruit fly:

Mulberry (*Morus nigra*); 800 fruits; 74 *D. dorsalis.*

Chicle (*Achras sapota*); 15 fruits; 227 *D. dorsalis;* also 7 *Ceratitis capitata* (Wiedemann).

Tahitian chestnut (*Inocarpus edulis*); 10 fruits; 12 *D. dorsalis.*

Egg fruit (*Lucuma nervosa*); 7 fruits; 99 *D. dorsalis;* also 4 *C. capitata.*

Loquat (*Eriobotrya japonica*); 200 fruits; 168 *D. dorsalis;* also 8 *C. capitata.*

*Culex quinquefasciatus* Say—Dr. Bonnet reported on finding 12 larvae of this culicid in a shipment of 200 bulldozer tires from Saipan landed in Honolulu March 18. An inspector of the Board of Agriculture & Forestry discovered the larvae and reported to the Division of Mosquito Control. An immediate inspection indicated that approximately 9 per cent of the tires contained larvae, and steps were immediately taken to spray them with DDT. From seven living larvae two male and one female *C. quinquefasciatus* were reared. There is no doubt concerning the foreign origin of this material.

*Pristomerus appalachianus* (Viereck)—Mr. Maehler reported the capture on January 28, 1947, at Hickam Field, Oahu of this nearctic ichneumonid wasp. This is the first record of its capture in the Territory. It is one of six armyworm parasites sent from Texas by Mr. Bianchi in 1942. The record is of particular interest because releases of the original material were made only on the islands of Hawaii and Maui.

*Dactylosternum dispar* Sharp—Mr. Nishida reported the capture of this hydrophilid beetle in decaying cactus plants on the McGuire ranch, Molokai by David Akana. Mr. Pemberton, who identified the specimen and who earlier reported the species from Kauai and Oahu (Proc. Haw. Ent. Soc., 12: 227, 233, 1945) states that this is the first record of this insect from Molokai.

*Chalybion bengalense* (Dahlbom)—Mr. Weber reported catching a female of this sphecid wasp in the rear of a store at Nanakuli, Oahu on April 3, 1947. This is the first record of this species from the Territory. When the area was revisited on April 13 a second specimen was caught, and two others were seen. This wasp is known from southern and eastern Europe, North Africa, India, Ceylon, China, Japan, Java and the Philippines.

*Xylotrechus colonus* Fabr.—A singel specimen of this cerambycid beetle was taken by Mr. Weber on the window of a store at Nana-

kuli, Oahu, on April 3. It is known from the eastern United States where it attacks many hardwoods, feeding under the bark. It has been found in birch, oak, hickory, chestnut and beech, with oak, chestnut and hickory the preferred hosts. It has also been found in ash and maple.

*Melittobia hawaiiensis* Perkins—Mr. Weber reported finding a 4-cell nest of *Eumenes pyriformis philippinensis* Bequaert from three cells of which he reared this eulophid parasite. The parasite was definitely breeding on the *Eumenes* pupae.

*Eumenes latreillei petiolaris* (Schulz)—Mr. Weber reported that when Mr. Maehler and he boarded the steamship Furman Victory, arriving at Iroquois Point, Oahu on April 6 from Manus and other south Pacific islands, they found many nests of this wasp on the rudder, propellers and cradles of two motorboats carried as deck cargo. In one nest were found several empty dipterous puparia, evidently of two species. Ashore, in cargo from this ship, Mr. Weber found a *Blatta orientalis* Linn., while from another vessel he found six species of tenebrionid adults and some larvae.

*Boiga* sp.—Mr. Weber reported that a large snake, about six feet long, was found alive April 7, 1947 on the steamship Furman Victory; it was promptly killed. It was tentatively determined as a species of *Boiga* (Colubridae) by Verne Brock, director of the Division of Fish and Game, Board of Agriculture & Forestry. Subsequently it was sent to the California Academy of Sciences, and determined by J. R. Slevin as *Boiga* probably *irregularis* (Merrem). It is not considered a dangerously poisonous snake. Following fumigation of the ship a small snake was found dead, on April 12. This was determined by the Chicago Natural History Museum as *Typhlops* probably *braminus* (Daudin).

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## MAY 12, 1947

The 497th meeting was held at the H.S.P.A. Experiment Station on Monday, May 12 at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Miss Suehiro; Messrs. Alicata, Bonnet, Dennery, Fullaway, Keck, Krauss, Nishida, Pemberton, Rosa, Sakimura, Stout, Swezey, Tanada, Tuthill, Van Zwaluwenburg, Weber, Williams and Zimmerman.

Messrs. John D. Sherman and D. O. Wolfenbarger were nominated for corresponding membership.

*Opius* (*Biosteres*) *longicaudatus* (Ashmead)—Mr. Fullaway exhibited specimens of this braconid parasite recently bred from *Dacus dorsalis* Hendel sent by Dr. Uichanco from the Philippines.

*Leucospis* sp.—Mr. Rosa exhibited three specimens of this chalcid wasp, a probable parasite of *Megachile* and *Lithurgus* bees, taken from a pile of timber at Nanakuli, Oahu, April 18, 1947. They are probably parasites locally of *Megachile* and *Lithurgus* bees. This is a new insect for the Territory.

*A termite on Canton Island*—Mr. Van Zwaluwenburg called attention to the description of a new termite, *Calotermes curvithorax* Kelsey (New Zeal. Jl. Sci. & Tech., **25** [Sec. B]: 45-53, 3 figs., 1943) from Canton Island where it was collected in May 1937. The species is said to be quite distinct from other described termites from the Pacific region. In a letter Mr. Kelsey says that the termites were found alive in an unidentified log of driftwood. This is evidence of one means by which termites can be spread from island to island. During the several weeks Mr. Van Zwaluwenburg spent on Canton in 1940 and 1941 he found no evidence of termites, either in local wood or in driftwood; nor were winged forms seen at lights. It is possible that the specimens described by Kelsey were from the only colony present, and that the species is not established on Canton. The origin of the infested log can only be guessed at, for although the usual drift of ocean currents to Canton is from the east and southeast, during January and February gales sometimes blow from the west. The termites were collected fully two years before materials from North America were brought to Canton by Pan American Airways construction crews.

*Aceria mangiferae* Sayed—Mr. Van Zwaluwenburg stated that in a note (Proc. Haw. Ent. Soc., 13: 25, 1947) concerning this eriophyid mite, the name is credited to Hassan. It now develops that Hassan's paper (Bul. Soc. Fouad 1er Ent., **28**: 179, 1944) contains no description of the mite, but confines itself to a discussion of its damage to mangoes, under the name *Eriophyes mangiferae*. The species has now been described (as *Aceria*) by M. Taher Sayed (Idem, **30**: 7-10, 6 figs., 1946), and he should be credited as its author.

*Withius* sp.—Mr. Krauss reported that specimens of this pseudoscorpion, only now identified, had been collected as follows: Honolulu, Oahu, May 2, 1943; Maui, June 6, 1943, under bark of dead *Aleurites moluccana* log; Waimea, Kauai, January 6, 1944, under stone; and Kailua, Kona, Hawaii, April 23, 1944, under stone. J. C. Chamberlin, who determined the specimens, states that they are closely similar to, or identical with, *Withius subruber* (Simon),

which is widely distributed in Europe and parts of North America. This is the first record of the genus from Hawaii.

*Solenopsis geminata rufa* (Jerdon)—Mr. Krauss exhibited specimens of the fire ant collected at Hilo, Hawaii, August 13, 1938. This appears to be the earliest collection of this species at Hilo. Dr. Swezey previously had collected it at Mahukona, Hawaii on May 13, 1931.

*Eumicromus navigatorum* (Brauer)—Wm. Kirch called Mr. Krauss' attention to three larvae of this hemerobiid lacewing feeding on palm aphids (*Cerataphis lataniae* [Boisduval]) on orchid plants in a greenhouse in the Makiki district of Honolulu, April 29. The larvae were reared to maturity.

*Chrysobothris* sp.—Mr. Dennery exhibited a specimen of this buprestid beetle taken at light on May 3, at the corner of Pensacola and Wilder Streets, Honolulu. The only other specimen known was taken within a few hundred yards of this locality on June 8, 1946.

*Eumenes latreillei petiolaris* (Schulz)—Mr. Weber exhibited a 14-cell nest of this wasp taken from the side of a warehouse at Hickam Field, Oahu on May 9. Ten of the cells contained pupae in various stages of development, and the other four contained fully-grown larvae. He remarked that he had found another nest in the same area, one cell of which contained two eggs, and another three eggs. At Nanakuli Mr. Weber observed a female of this wasp carrying a cockroach of the *Graptoblatta* or *Supella* type; unfortunately when captured she dropped the cockroach, which fell into the pile of logs and could not be recovered. He further reported capturing on May 4 a specimen of *Eumenes pyriformis philippinensis* Bequaert at Reservoir 7, Honouliuli, Oahu, where he also saw *Chalybion bengalense* (Dahlbom).

*Procecidochares utilis* Stone—Mr. Sakimura reported that a stray plant of pamakani (*Eupatorium adenophorum*) in the native forest on Wiliwilinui Ridge, 1800 ft. elevation, above Waialae, Oahu, was found on May 11 to be heavily infested by this trypetid fly, recently introduced from Mexico. According to Mr. Fullaway, who examined the specimens, the nearest site of the original liberations was on Tantalus, and the present discovery indicates a natural spread of the insect of four miles.

*Phrynosoma douglassii hernandesi* (Girard)—Mr. Fullaway stated that a specimen of this, the Arizon short-horned "toad" had been found recently on Wilhelmina Rise, Honolulu. It is believed to be established here for several persons have reported seeing it.

*Icerya aegyptiaca* (Douglas)—Mr. Pemberton reported that D. B. Langford, entomologist for the U.S. Commercial Company, Pacific Ocean Areas, had found this coccid on breadfruit trees on Rota

Island in the Marianas, and that it was being preyed upon by a coccinellid tentatively identified by Mr. Zimmerman as *Rodolia pumila* Weise. These insects were collected by Mr. Langford on Rota late in April 1947. *Icerya aegyptiaca* is especially injurious to breadfruit in certain Pacific islands, and the discovery of a species of *Rodolia* associated with it is of definite economic importance. Mr. Langford also submitted specimens of *Coelophora inaequalis* (Fabr.) found feeding on aphids on taro at Rota.

*Eucelatoria armigera* (Coquillett)—Mr. Pemberton reported rearing this tachinid from a larva of the sugar cane leaf-roller (*Omiodes accepta* [Butler]) collected at Kohala, Hawaii in April 1947. This is a new host record for this fly. Other hosts in Hawaii to date are *Plusia chalcites* (Esper), *Laphygma exempta* (Walker), *Heliothis armigera* (Hübner), *Achaea janata* (Linn.), *Polydesma umbricola* Boisduval, *Hymenia recurvalis* (Fabr.) and *Amyna natalis* (Walker).

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## JUNE 9, 1947

The 498th meeting was held at the H.S.P.A. Experiment Station on Monday, June 9, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Alicata, Balock, Bonnet, Fullaway, Kartman, Krauss, Nishida, Pemberton, Rosa, Sakimura, Schmidt, Tanada, Tuthill, Van Zwaluwenburg, Williams and Zimmerman.

*Visitor:* Mr. Charles R. Joyce.

Messrs. John D. Sherman and D. O. Wolfenbarger were elected to corresponding membership. Mr. C. R. Joyce was nominated for membership.

### NOTES AND EXHIBITIONS

*Dacus dorsalis* Hendel—Mr. Pemberton reported rearing, on June 5, a single specimen of this trypetid from a fruit of Hawaiian ti (*Cordyline terminalis*), collected on the grounds of the H.S.P.A. Experiment Station, Honolulu on May 23. Mr. Van Zwaluwenburg reported rearing adults of this same fruit fly from field-collected berries of the Chinese inkberry (*Cestrum diurnum*) in Honolulu, June 20. This brings to 44 plant species the total of field-collected host fruits of this fly; these are distributed among 23 botanical families.

*Procecidochares utilis* Stone—Mr. Sakimura reported that a sparse infestation of this Mexican gall fly on pamakani was found May 30, along the ridge between Mauna Kapu and Palikea, at from 2700-3100 ft. elevation, near the southern extremity of the Wai-

anae Range, Oahu. This represents a wide dispersal from the original liberation points, Nuuanu pali and Mt. Tantalus.

*Dendrothripoides ipomoeae* Bagnall—For Mr. Look, Mr. Sakimura reported that infestations of this thrips were found on sweet potato at Mountain View and Kapoho, Hawaii, in August 1946. This is a new island record.

*Lycastris hawaiiensis* Johnson—Mr. Van Zwaluwenburg reported that this nereid worm was found in considerable numbers by Dr. Williams and himself in muddy water on one of the sugar plantations on Oahu, April 2. Identification was made by Dr. C. H. Edmondson of the Bishop Museum. The species was described (Mark Anniversary Volume, art. 10: 205, 1903) from specimens taken in a freshwater spring near Honolulu.

*Metioche* sp.—Mr. Zimmerman reported he had observed these small crickets feeding upon the pollen of *Sonchus, Solanum, Euphorbia* and *Amaranthus* in his garden in Manoa Valley, Honolulu; they are now very abundant. He also reported seeing the larrid wasp, *Liris aurata* (Fabr.) in the garden. He also observed mynah birds and English sparrows feeding on *Polydesma* caterpillars.

*Calosoma semilaeve* LeConte—Mr. Fullaway exhibited this carabid beetle collected in numbers by Mr. Look and Dr. Swezey at Waikii, Hawaii, in May 1947. It was introduced from Ventura County, California in May 1923, and releases were made on the Parker Ranch and at Honokaa, on the island of Hawaii. This is the first record of its establishment in the Territory.

*Polistes* and *Hermetia*—Mr. Pemberton reported that he had observed a *Polistes* wasp working on the stratiomyid fly, *Hermetia illucens* (Linn.), detaching its wings.

*Stegonotus modestus* (Schlegel)—Mr. Krauss reported the capture, May 20, 1947, of a live specimen of this harmless water snake from a ship arriving at Pearl Harbor from Manus Island. The vessel had been fumigated with cyanide gas. The identification was made by J. R. Slevin.

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## JULY 14, 1947

The 499th meeting was held at the H.S.P.A. Experiment Station on Monday, July 14, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Bonnet, Carter, Fullaway, Joyce, Krauss, Nishida, Pemberton, Rosa, Sakimura, Swezey, Tanada, Tuthill, Weber, Williams and Zimmerman.

*Visitors:* Messrs. J. F. Kagy and G. B. Mainland.

Mr. C. R. Joyce was elected to membership in the Society. Mr. Wm. E. Stone was nominated for corresponding membership and Dr. G. B. Mainland for active membership.

To commemorate the 500th meeting of the Society, which will be held next month, it was unanimously voted to send five C.A.R.E. packages to the Imperial Bureau of Entomology in London.

NOTES AND EXHIBITIONS

*Lycastris hawaiiensis* Johnson—Mr. Fullaway reported that this nereid worm was collected from taro patches in 1910 by Dr. Wayson, who identified the material.

*Frankliniella minuta* (Moulton)—Mr. Sakimura reported that this common flower thrips of the Pacific coast has found established here some time ago and is now well established on the island of Oahu. It is common on a roadside weed (*Verbesina encelioides*) throughout the lowland zones. Large populations were found at Maili, Honouliuli, Waipahu, Waiawa, Damon Tract, Kalihi, Manoa, Kahala, Koko Head, Makapuu, Waimanalo, Kailua, Laie, Kahuku, Paumalu, Waialua, Kealia, Wahiawa and Kunia. The first collection was made at Maili, Waianae district, on October 26, 1946. Although no data are available from the other islands, the situation is very likely to be similar to that on Oahu. This species is one of the possible vectors of the spotted wilt virus and experiments with it are now under way.

*Pseudococcus pseudonipae* (Cockerell)—Dr. Swezey exhibited specimens of this mealybug on guava and reported a small infestation at the site of the old Volcano House at Kilauea, Hawaii, June 1947.

*Meteorus laphygmae* Viereck—Dr. Swezey reported rearing this braconid from a larva of *Phlyctaenia stellata* (Butler) on *Pipturus* in the Kilauea area, Hawaii, June 13, 1947. It is remarkable that this parasite, introduced as an armyworm parasite from Brownsville, Texas in 1942, should already have found its way into the native forest at 4000 feet elevation.

*Horogenes* (*Dioctes*) *chilonis* (Cushman)—Dr. Swezey exhibited a specimen of this ichneumonid which he had reared from a larva of *Bactra straminea* (Butler) at Kilauea, Hawaii, May 31. This parasite was introduced from China in 1928 as a parasite of the rice borer, *Chilo suppressalis* Walker (*Chilo simplex* [Butler]). *Bactra straminea* is a stem borer in sedges, and the stems of *Cladium angustifolium*, a large sedge which is quite common in the Kilauea area, are frequently found bored, and the larvae often found to be parasitized. *Bactra* also has another enemy (rat or mongoose), for in one clump of the sedge 12 stems were slit open near a node where there would have been a larva or pupa of *Bactra*.

*Sphaeridium scarabaeoides* (Linn.)—Dr. Swezey reported finding this introduced beetle in cowdung at Waikii, Hawaii, June 12, 1947, by Mr. Look and himself. It is the first record of its occurrence on the island of Hawaii.

*Canthon humectus* (Say)—Dr. Swezey exhibited a specimen of this scarabaeid beetle collected in cowdung at Waikii, Hawaii, June 12, 1947 by Mr. Look and himself. It is an introduced species from Mexico, sent by H. T. Osborn in 1923. This is its first recovery. It was found in company with *Onthophagus incensus* Say, a species first recovered in 1934. Synonymy of *C. humectus: Ateuchus humectus* Say (Say, New Species of N. A. Insects, p. 4, 1832); *Ateuchus humectus* Say (LeConte, Say's Entomology of North America, I: 301, 1891); *Canthon gagatinus* Harold (Ann. Soc. ent. France: 173, 1862); *Canthon humectus* (Say) (Bates, Biol. Centr.-Americana, Coleop., II, pt. 2: 386, 1886-1890).

*Ergates spiculatus* (LeConte)—Mr. Krauss stated that several larvae of this western American cerambycid beetle, the spined pine borer, were collected in sound timbers in a lumber yard at Pier 39, Honolulu, on July 8, 1947. The timbers had been brought from California on February 27.

*Another snake capture*—Mr. Krauss reported that on March 27 a live eastern ring-necked snake *(Diadophis punctatus* [Linn.]) was found and killed in the hold of a vessel at a Honolulu pier; the ship had arrived from New Orleans.

*Lygus elisus* Van Duzee—Mr. Pemberton exhibited a specimen of this mirid bug which was taken in a light trap at Iroquois Point, Oahu, July 9, 1947. The species was identified by Mr. Zimmerman. It is a new insect in Hawaii. On July 14 Messrs. Zimmerman, Rosa and Pemberton visited the locality and found the bug breeding extensively on a common weed, *Chenopodium album.* This insect occurs in the western United States, where it is considered native. It is known as the "pale legume bug," and is a pest of beans, cotton, alfalfa and sugar beets. It also breeds on a number of other plants. It is definitely a very undesirable introduction into Hawaii.

*Aeolus mellilus comis* (LeConte)—Mr. Pemberton exhibited this elaterid beetle caught in considerable numbers in the light trap at Iroquois Point, Oahu, July 9, 1947. Identification was made by Dr. Williams. This beetle is apparently now firmly established on Oahu. Previously a single specimen was collected at Nanakuli, Oahu in June 1935, and another in a light trap at Naval Air Station, Honolulu in July 1944.

*A new tenebrionid*—Mr. Pemberton exhibited a single specimen of an unidentified tenebrionid beetle taken in the Iroquois Point light trap on July 9, 1947. This beetle has not previously seen in Hawaii.

*Dacus dorsalis* Hendel—Mr. Rosa exhibited a seed capsule of spider lily (*Crinum* sp.) which had been stung by this trypetid fly. Although the material was held for some time, no flies issued from it.

*Sauba ant*—Dr. Carter exhibited a photograph taken at Recife, Brazil, of a nest of *Atta sexdens* (Linn.). These heaps of soil occupied an area of 65 square yards. A single application of DD in each of the ants' tunnels effectively destroyed the nest.

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## AUGUST 11, 1947

The 500th meeting was held at the H.S.P.A. Experiment Station on Monday, August 11, at 2:00 p.m., with Vice-President Fullaway in the chair.

*Members present:* Miss Suehiro; Messrs. Alicata, Fullaway, Joyce, Kartman, Keck, Rosa, Sakimura, Swezey, Tanada, Weber, Williams and Zimmerman.

Dr. G. B. Mainland was elected to membership in the Society, and Mr. Wm. E. Stone to corresponding membership.

### NOTES AND EXHIBITIONS

*Two new insects*—Mr. Zimmerman reported that two insects new to the Territory had recently been taken in the light trap at Iroquois Point, Oahu. One, taken July 30, 1947, is a species of *Fulvius*, a mirid bug very like one introduced years ago from the Philippines as a possible predator on the eggs of the sugar cane beetle borer (*Rhabdoscelus obscurus* [Boisduval]). The other, captured August 4, 1947, is a monotomid beetle, of a genus new to the Islands.

*Phymatodes nitidus* LeConte—Dr. Swezey reported for Mr. Davis that a specimen of this cerambycid beetle had issued from a redwood cone given him by a recent visitor to Hawaii National Park. The cone was from the Sequoia National Park in California. The beetle had been sent to Dr. Swezey for confirmation of the identification. In Essig's "Insects of Western North America" this beetle is said to "mine dead wood of Monterey cypress, redwood, juniper and related trees, and ranges from California into British Columbia."

*Dacus dorsalis* Hendel—Dr. Swezey reported for Mr. Davis the rearing of this fruit fly from Jerusalem cherries (*Solanum pseudocapsicum*). The results listed below are from 18 fruits collected from plants at Kipuka Ki, Hawaii, at an elevation of between 4000 and 4500 feet, June 4; the insects issued between June 18 and July 4.

| | |
|---|---|
| *Dacus dorsalis* Hendel | 23 |
| *Ceratitis capitata* (Wiedemann) | 11 |
| *Diachasma tryoni* (Cameron) | 9 |
| Undetermined phorid flies | 10 |

The first record of *D. dorsalis* in the Hawaii National Park was in September, 1946. Since then it has been found widely distributed from sea level to 5500 feet elevation. Jerusalem cherry is probably a new host record, and is found growing abundantly in Kipuka Ki at an elevation of between 4000 and 5000 feet, where it fruits prolifically.

*Elaphria nucicolora* (Guenée)—Dr. Swezey reported finding one specimen of this agrotid moth among other moths collected in light trap, June 4, at the Hawaii National Park by Mr. Davis. It is the first record of this new immigrant from the island of Hawaii.

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## SEPTEMBER 8, 1947

The 501st meeting was held at the H.S.P.A. Experiment Station, on Monday, September 8, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Alicata, Balock, Bonnet, Carter, Fullaway, Holdaway, Joyce, Kartman, Keck, Krauss, Maehler, Mainland, Nishida, Pemberton, Ritchie, Rosa, Sakimura, Swezey, Tanada, Tuthill, Weber, Williams and Zimmerman.

*Visitors:* Messrs. L. B. Loving, J. H. Permar and H. I. Rainwater.

### NOTES AND EXHIBITIONS

*Euryrhopalus pretiosa* (Timberlake)—Mr. Fullaway exhibited specimens of this encyrtid reared August 25, 1947 from *Pseudococcus brevipes* (Cockerell) on *Carissa* collected at Lanikai, Oahu. This is the first recovery of the insect in Hawaii. Introductions have been made at various times since 1922, from Mexico, Guatemala and British Guiana. The 1936 shipment from British Guiana was propagated extensively and by 1938 over 6000 individuals had been liberated in pineapple fields on the various islands producing pineapples. It is probably from this introduction that the species became established. It was noted at that time that the British Guiana specimens differed in some respects from the Mexican, but after study of the material at hand it is believed there is only one species involved, and that the differences noted represent sexual dimorphism and variation within the species.

*Corn earworm attacking gladiolus*—Mr. Fullaway reported that in the latter part of August a flower grower in the Kahala-Waialae

district of Honolulu reported damage to blooms by a wasp. Examination showed *Pachodynerus* tearing the flowers while searching for corn earworms (*Heliothis armigera* [Hübner]). Resumption of regular spraying operations stopped the attacks.

*Ethmia colonella* Walsingham—Dr. Swezey, who has had a few kou trees (*Cordia subcordata*) under observation, reported that he visited the *Cordia* tree at Barber's Point, Oahu in August and found no evidence of *Ethmia* caterpillars. However, he exhibited leaves from some of the lower branches, some of which were completely riddled by *Adoretus* beetles, and others almost completely cut away by leafcutter bees (*Megachile*) which line the cells of their nests with small pieces of leaves appropriately cut for the purpose.

*Brachistella lutea* (Fullaway)—Mr. Sakimura reported rearing this trichogrammatid parasite of grass leafhoppers, from an unidentified host in bristly foxtail grass (*Setaria verticillata*) growing on the University campus. The determination was made by Mr. Fullaway. This parasite has not been found in recent years, but was recorded several times in 1913, and once each in 1921 and 1933.

*Apanteles praesens* Muesebeck—Mr. Krauss reported that this braconid parasite of the geometrid moth, *Anacamptodes fragilaria* (Grossbeck) is described as a new species in the Pan-Pacific Entomologist, **23**: 23-24, 1947. It is described from specimens collected at Pasadena and Los Angeles, California, and from specimens bred in the laboratory in Honolulu. This wasp has been introduced into Hawaii and liberated to control *Anacamptodes*, but is not known to be established.

*Weevils in pineapple*—Mr. Krauss reported that the weevil, *Metamasius callizona* (Chevrolat) (determination by G.A.K. Marshall) was found to be abundant in a small pineapple field at Amatlan, near Cordoba, Vera Cruz, Mexico, on February 8, 1947. The larvae were causing considerable damage to pineapple plants of the "criollo" variety by boring in the stem. A number of adults were found in the plants. This weevil is apparently rare or unknown in the more important pineapple districts of Mexico. A single adult of *Metamasius dimidiatipennis* (Jekel) (determination by L. L. Buchanan) was collected on a pineapple plant at Paja, Panama on August 3, 1946.

*Phrynosoma cornutum* (Harlan)—A single live individual of the Texas horned "toad," determined by Dr. Williams, was reported by Mr. Krauss to have been confiscated from a passenger arriving by ship from California on August 25. This lizard ranges from Kansas and Colorado south to Texas and northern Mexico, and west to New Mexico and southeastern Arizona, according to Van Denburg.

*Dacus dorsalis* Hendel—Dr. Carter reported rearing this trypetid fly from a fallen peach collected at 3600 ft. elevation on the slopes of Haleakala, Maui. Dr. Tuthill reported the presence of this fly on Niihau, a new island record, in August 1947.

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## OCTOBER 13, 1947

The 502nd meeting was held at the H.S.P.A. Experiment Station, on Monday, October 13, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Balock, Bonnet, Fullaway, Holdaway, Ito, Joyce, Krauss, Maehler, Nishida, Pemberton, Rosa, Sakimura, Swezey, Tanada, Tuthill, Weber, Williams and Zimmerman.

### NOTES AND EXHIBITIONS

*Megamelus prosperina* Kirkaldy—Mr. Fullaway reported that Mr. Look had discovered the taro leafhopper in and around Hilo, Hawaii, September 19; and that Mr. Au had found it in Hanapepe Valley, Kauai, on September 28.

*Glyptocolastes* sp.—Mr. Fullaway stated that the immigrant braconid taken by J. S. Rosa at Iroquois Point, Oahu, August 1947 in light traps has been tentatively identified as belonging to this genus.

*Dacus dorsalis* Hendel—Mr. Fullaway reported that this fruit fly was reared from egg to adult in 16 days in banana, and in 23 days in papaya. He also stated that the eulophid parasite, *Syntomosphyrum indicum* Silvestri had been reared from egg to adult in 13 days (March), and the braconid *Opius* (*Biosteres*) *longicaudatus* (Ashmead) in 20 days (September-October).

*Eumenes latreillei petiolaris* (Schulz) — Mr. Weber reported that according to Dr. Bequaert, this is the correct name for the eumenid wasp formerly known locally as *E. pyriformis petiolaris*.

*Euryrhopalus pretiosa* (Timberlake)—Mr. Sakimura reported as follows: The records appearing in the Proceedings, of field releases of this encyrtid parasite of *Pseudococcus brevipes* (Cockerell), are found to be incomplete. This parasite was imported from Central and South America, and was recently found by Mr. Fullaway to be established on Oahu. A brief note (Proc. Haw. Ent. Soc., **10**: 352) is the only one on the 1935 and 1937 releases. The first shipment was received from Mexico by the Board of Agriculture & Forestry in 1922, but field releases were apparently not made, or are not recorded at least. The next shipment was from Guatemala by the Pineapple Research Institute in 1935, and about 200 adults were released on the Wahiawa plain, Oahu. The third

shipment was received from British Guiana by the same institution in 1936. Extensive breeding was done, and the following numbers of adults were released in 1937 and 1938 in pineapple fields on the five Hawaiian islands growing pineapples, and on Mindanao in the Philippines: Oahu 2427 (Wahiawa plain); Maui 1624; Kauai 1364; Molokai 185; Lanai 257; Mindanao 140; total 5997. A fourth shipment was received from Guatemala by the P.R.I. in 1937, but no release was made from this source. Mr. Fullaway studied the material and decided that the species from Mexico, Guatemala and British Guiana were identical. This parasite is parasitic on the non-green-spotting strain of *P. brevipes,* but not on the green-spotting strain.

*Trichophasia ni brassicae* (Riley)—Dr. Swezey reported finding an adult of this plusiid moth in light trap material collected in August 1947 by Mr. Davis at the Hawaii National Park; it is the first record of its occurrence in the Park. In a recent letter Mr. Look says the caterpillars of what he believes to be this moth were abundant on cabbage in February and May 1946 at Ahualoa, in the homestead region above Honokaa on the road to Waimea. The moths were not reared.

*Ampulex compressa* (Fabr.)—Dr. Swezey reported that Mr. Look recently found this cockroach-hunting wasp in the Hilo district. This is not, however, the first report of it from the island of Hawaii.

*Canthon humectus* (Say)—Dr. Swezey read for Mr. Look the following note on this scarabaeid beetle on Hawaii: "While traveling along the Waikii highway I noticed numerous strange objects moving across the road. Upon investigating, I learned that they were balls of manure (diameter about 14 mm.) being pushed by blue dung beetles of this species. Each ball was attended by two beetles, a large and a small (the latter probably the male). The smaller beetle always clung to the side of the ball, while the larger, walking backwards on its forelegs, rolled the ball with its hind legs. I presume they use this material for breeding."

*Orchidophilus peregrinator* Buchanan—Dr. Swezey reported that Mr. Look had sent him a specimen of this orchid weevil from Hilo, Hawaii, where a severe infestation was found, September 15, on various species of *Vanda.* This is the first time this weevil has been found in Hilo. Upon inquiry Mr. Look found that a great number of *Phalaenopsis* were destroyed by a weevil thirteen years ago, but what the species was is not known. Possibly it could have been another weevil as *Orchidophilus aterrimus* (Waterhouse) was first reported from Hilo in 1930 by L. W. Bryan (Proc. Haw. Ent. Soc. 7: 376, 1931).

*Trichoclea postica* Smith—Dr. Swezey exhibited five specimens of this recent immigrant agrotid moth, taken in a light trap at Iro-

quois Point, Oahu, September 11, 18 and 30, 1947. Identification was made by Dr. Swezey and later confirmed by Dr. J. A. Comstock of the Los Angeles Museum. The species was described from Colorado (Trans. American Ent. Soc., **18**: 115, 1891) and occurs also in southern California, where a related species breeds on *Atriplex*.

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## NOVEMBER 10, 1947

The 503rd meeting was held at the H.S.P.A. Experiment Station, on Monday, November 10, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Messrs. Bonnet, Dennery, Fullaway, Holdaway, Joyce, Keck, Mainland, Nishida, Pemberton, Ritchie, Rosa, Swezey, Tanada, Tuthill, Van Zwaluwenburg, Weber and Zimmerman.

*Visitor:* Mr. C. E. Cooley.

The following resolution, expressing appreciation of Dr. Williams' long service to the Society, was unanimously passed:

Be it *Resolved*, That the Hawaiian Entomological Society extend to Dr. F. X. Williams, on this, the thirtieth anniversary of his joining the Society, its greetings and sincere appreciaton for the outstanding contributions he has made to Hawaiian entomology.

Be it further *Resolved*, that the Society express its thanks for the many years of service Dr. Williams has given as one of its officers, and for his valued contributions to its program.

And be it further *Resolved*, that this resolution be spread upon the minutes of the Society, and that a copy be forwarded to Dr. Williams.

### PAPER

Mr. Van Zwaluwenburg presented a paper entitled: "New Species and new Records of Elaterid Beetles from the Pacific—III."

### NOTES AND EXHIBITIONS

*Melanolestes picipes abdominalis* (Herrick-Schaeffer)—Mr. Zimmerman reported the capture by Mr. Rosa, of this reduviid bug, new to Hawaii, in a light trap at Iroquois Point, Oahu on October 30, 1947. Identification was by Dr. Usinger who states that bugs of this genus are reported to be predaceous on scarabaeid grubs.

*Phytomyza spicata* Malloch—For Mr. Look, Mr. Fullaway reported the recovery on October 22, 1947, of this agronyzid fly at Makapala, Kohala, on the island of Hawaii, a new island record. The following microhymenoptera, identified by Mr. Fullaway, were

bred by Mr. Look from a heavy infestation of *Phytomyza* in Johnson grass from Kohala: the eulophids *Hemiptarsenus semialbiclavus* (Girault), *Achrysocharis fullawayi* (Crawford) and *Closterocerus* sp., and the pteromalid *Merisus* sp.

*Dacus dorsalis* Hendel—Mr. Keck reported that in the laboratory, mating by this trypetid fly was observed to take place about one hour after dark. Flies did not mate until 22 days after emergence, though this may vary and may depend upon the type of food they receive.

*Pectinophora gossypiella* (Saunders)—Dr. Swezey reported having reared the pink bollworm from cotton seeds on a tree in his garden in Manoa in October. The tree had been producing bolls continuously for five years, but no infestation by the pink bollworm had occurred until now, although infestation had been observed on an older tree about 100 yards away in neighboring grounds.

*Allograpta exotica* (Wiedemann)—Mr. Weber exhibited specimens of this syrphid fly (synonym *A. fracta* O.S.), a species not previously recorded from the Territory. It has been confused with *A. obliqua* (Say) from which it differs principally by the presence of a black stripe on the frons, and in the extent of the pleural markings. It was first found in Hawaii in Wailau Valley, Molokai, July 4, 1933, by Miss Suehiro, and later (May 18, 1940) at Aiea, Oahu, by Ah Sing Akeo. It is known from California, Central America, Ecuador and Uruguay.

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## DECEMBER 8, 1947

The 504th meeting was held at the H.S.P.A. Experiment Station, on Monday, December 8, at 2:00 p.m., with President Bonnet in the chair.

*Members present:* Miss Amy Suehiro; Messrs. Balock, Bianchi, Bonnet, Bryan, Carter, Davis, Fullaway, Holdaway, Joyce, Kartman, Keck, Krauss, Lewis, Mainland, Nishida, Pemberton, Ritchie, Sakimura, Swezey, Tanada, Tuthill, Van Zwaluwenburg, Weber and Zimmerman.

*Visitor:* Miss J. Yuen.

This being the annual meeting, the following slate of officers to serve during the coming year, was presented:

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| President | D. T. Fullaway |
| Vice-President | J. W. Balock |
| Secretary-Treasurer | R. H. Van Zwaluwenburg |
| Additional Members of Executive Committee | D. D. Bonnet<br>L. D. Tuthill |

There being no further nominations the above nominees were elected to office.

President Bonnet relinquished the chair to Mr. Fullaway, the President-elect, and presented the annual presidential address: "Certain Aspects of Medical Entomology in Hawaii."

PAPERS

Dr. Swezey presented a paper entitled: "New Species of Hawaiian Lepidoptera." Mr. Tanada presented a paper by O. C. McBride and himself: "A revised Host List of Melon Fly in Hawaii."[1] Mr. Zimmerman presented his paper: "Notes on Marianas Islands Curculionidae (Coleoptera)," as well as one by E. B. Britton entitled: "The Carabid Tribes Harpalini, Lebiini and Bembidiini in Hawaii (Coleoptera)." He also presented the following: "A new Genus and Species of Aradidae from Fiji (Hemiptera)," by Robert L. Usinger; "The Occurrence of Oxyethira maya in Hawaii (Hydroptilidae: Trichoptera)" by Herbert H. Ross; and "A Taxonomic Study of Hawaiian Ephydridae (Diptera) related to Scatella Robineau-Desvoidy" by Willis W. Wirth.

NOTES AND EXHIBITIONS

*Euryrhopalus pretiosa* (Timberlake)—Dr. Carter reported the establishment of this Mexican encyrtid on the island of Kauai. Three females and one male emerged from mummies of *Pseudococcus brevipes* (Cockerell) collected from Field K-1, Kauai Pineapple Co., November 14, 1947. The only other parasite species encountered was the encyrtid *Anagyrus coccidivorus* Dozier, which was present in two fields of Kauai Pineapple Co., and one of Hawaiian Canners at Kapaa.

Effect of DDT on enemies of *Pseudococcus*—Dr. Carter added that it is of interest to note that one of the pineapple fields in which *Anagyrus* was found had been heavily sprayed with DDT over a period of several months. A similar observation was recently made on Molokai where plants sprayed ten days previously with a heavy oil-DDT spray showed *Cryptolaemus* larvae and several mealybug mummies from which *Anagyrus* later emerged, while the colony of mealybugs had the typical appearance of a predator-attacked colony in the absence of ants. The activity of the parasites and predators was attributed to the suppression of ant activity by the DDT. The insecticide had apparently not interfered seriously, if at all, with the parasites and predators.

*Biological control of mealybug wilt*—Dr. Carter reported that a unique case of biological control of mealybug wilt of pineapples was reported, and observed by him, in a field of Baldwin Packers, on

[1] This paper has been delayed and will be published in the next issue of these Proceedings.

western Maui. This field was planted in September, 1944, and except for the field edges, showed a low percentage of mealybug infestation throughout until April, 1945. There had been practically no spraying during this interval. Populations then began to build up, and by December, 1945 there were very large populations of *P. brevipes* throughout the field. The plantation superintendent at that time reported that enormous numbers of coccinellids had appeared and cleaned up the mealybug colonies thoroughly. Dr. Carter inspected the field in May, 1947, shortly before the ratoon crop. By this time scattered high populations of mealybugs had built up again, but there was evidence of intense activity by predators, and some evidence of parasitism. Fruits were going into the cannery clean of base populatons, and with no leakage. Only the edge of the field which had been subject to continuous infestation from the outside showed wilt, and this edge strip was badly wilted. The main area was practically wilt-free.

*Orosius argentatus* (Evans)—Mr. Zimmerman reported that Dr. P. W. Oman states that the cicadellid leafhopper *Nesaloha cantonis* (Pan-Pacific Ent. **19**: 33, 1943) is a synonym of *Orosius argentatus* (Evans). This insect was redescribed from Canton Island and has recently been found to have a wide distribution in the Pacific. It was originally described as *Thamnotettix argentata* (Papers & Proc. Royal Soc. Tasmania for 1938: 15, pl. 3, fig. 5, 1939), from Australia.

Variations in *Dacus dorsalis* Hendel—Dr. Mainland presented the following note: In Hawaii the predominant color of thoracic calluses of *Dacus* (*Chaetodacus*) *dorsalis* is lemon yellow. From various localities on Oahu from 5 to 10 per cent of the adults have white thoracic calluses. In October four mosaic specimens were examined, in each of which some calluses were yellow and others white. Therefore it appears that the white color is a genetic variant of yellow.

Dark spots at the base of the fronto-orbital bristles have been used both by Hendel and Shiraki to separate *D. dorsalis* from *D. ferrugineus* Fabricius. Examination of material from the Territory shows that specimens vary from those with no spotting to those with very distinct spots. Hence the taxonomic value of this character is doubtful.

*Flies on Wake Island*—Mr. Bryan reported that airport personnel on Wake Island had complained of numerous flies on that island. Specimens submitted were identified as *Chrysomyia megacephala* (Fabr.), and the house fly with the narrow-fronted male, variously identified as *Musca vicina* Maçquart and as a variety of *Musca domestica* Linn. Both species breed in a great variety of decaying animal and vegetable materials, ranging from dead birds to human excreta.

*Leucospis affinis* Say—Mr. Weber reported that the new *Leucospis* first found by Mr. Rosa on April 18 at Nanakuli, Oahu, has been determined by both A. B. Gahan and James Rehn to be this widespread nearctic species.

A new *Pison*—Mr. Weber exhibited specimens of a *Pison* new to the Islands, taken November 2, 1947 on Kawaiiki trail, Koolau Mts., Oahu. The behavior of two of the individuals was interesting. Instead of imbibing water at the edge of the mud puddle at which they were captured, they alighted, apparently deliberately, on the surface of the water with legs outspread, and to all indications were obtaining their water in this manner.

*Procecidochares utilis* Stone—Mr. Krauss reported that stem galls of this introduced Mexican trypetid fly were found abundantly on pamakani plants (*Eupatorium adenophorum*) in the upper part of Maunalei gulch, Lanai, on October 28, 1947. As far as is known this fly was never liberated on Lanai, and seemingly it has reached that island through its own efforts. The galls were also numerous on pamakani growing along the Olinda pipeline road, Maui, and were found in Keanae Valley, Maui in November.

*Oechalia* attacking *Anacamptodes*—Mr. Krauss reported that several nymphs of the pentatomid *Oechalia pacifica* (Stål) (determined by E. C. Zimmerman) were found feeding on larvae of the geometrid *Anacamptodes fragilaria* (Grossbeck) on kiawe (*Prosopis chilensis*) at Kihei, Maui, on November 11. A few assasin bugs (*Zelus renardii* Kolenati) were also present, but none were observed attacking the geometrid larvae.

*Nysius delectus* White—Mr. Krauss reported that many thousands of this mirid bug (determined by Mr. Zimmerman) were observed in a small area a few yards across along the Olinda pipeline, Maui, on November 14. The bugs were resting in masses on ferns, lehua plants and other vegetation, or flying about.

*Agrotis coniotis* Hampson—For Mr. Look, Dr. Swezey reported the rearing of this agrotid moth from foliage of *Chenopodium* at Pohakuloa, Hawaii, in October 1947. Mr. Look and he had found the small caterpillars quite common there in June, but failed to rear any for determination. This recent rearing definitely connects *A. coniotis* with the *Chenopodium*. Two tachinid parasites were reared by Mr. Look from *Coniotis* larvae: *Frontina archippivora* Williston and *Chaetogaedia monticola* (Bigot).

## Fleas of Western North America. Their Relation to Public Health[1]

(A Review)

By C. E. PEMBERTON

This profusely illustrated volume treats of 66 genera and 236 species and subspecies of fleas occurring within that great area of North America west of the 100th meridian. The author has well stated that this region is the "flea collector's paradise." It becomes particularly so with the present volume in the collector's hands. Any ambitious entomologist seeking some group of insects in which to specialize, would find this book an ideal guide and stimulus to the study of fleas. Those who are already familiar with the published work of important contributors to flea taxonomy in this region will be much interested to see the excellent photographs of 15 of the pioneer and modern workers, and to read the pertinent comment on their accomplishments.

With the many hundreds of excellent drawings, clearly reproduced and labeled, one is able to interpret the keys and descriptions particularly well. Since the identification of fleas can only be accomplished through a study of characters discernible under the microscope, the proper preparation of slide mounts is of the greatest importance. In this, the laboratory technique adopted by the author is given in careful detail in Chapter 3. By following these instructions the technician will have not only beautiful material to work with, but also, in the words of the author, "something of which he can be justly proud." It is gratifying to note that considerable emphasis is given to this subject.

Summarized in Chapter 2 is a brief but comprehensive history of fleas in relation to public health in western North America, and in Chapter 4, which treats of the anatomy of the flea in relation to its taxonomy, the student will find very helpful instruction accompanied by series of good illustrations.

Finally, in Part III, appears an elaborate host index, composed of some 120 pages of exceedingly useful information. It is much more than an index since data are included on the geographical distribution of the hosts, their nesting habits, their relation to tula-

[1] By C. Andresen Hubbard. The Iowa State College Press, Ames, Iowa, 1947. ix 533 pp.; illus. $6.00.

remia, plague and murine typhus, and in addition is given much descriptive matter by which many of the hosts may be identified. This index, together with practical instruction on methods of trapping the various hosts, found in Chapter 3, will prove invaluable to entomologists investigating fleas in western North America.

Concluding with a selected bibliography, a synonymic index, a rapid checking index, an authors' index and a complete general index, little is left to be desired, all in a single volume, by future students of fleas within the territory covered by the monograph.

# Certain Aspects of Medical Entomology in Hawaii

By DAVID D. BONNET

*(Presidential address, presented at the meeting of December 8, 1947)*

## Introduction

One of the benefits which can be ascribed to the recent war (if one can say war produces any benefits) has been an increased recognition of the importance of insects in the transmission of disease. Doctors with the armed forces came in contact with malaria, dengue, tsutsugamushi, plague, filariasis, endemic typhus, dysenteries, and many other diseases which they had heard of but had never seen before. Specialized groups were organized by the armed forces to study these relatively unknown diseases and entomologists were prominent as members of these teams. Considerable publicity was given to the development of new insecticides of which DDT is, perhaps, the best known. Better insect repellents and substitutes for quinine were discovered. These facts together awakened the interest of the public toward the problems of insect-borne diseases.

A cursory examination of the recent entomological journals demonstrates the contribution of entomologists to the war. Because of this general enlightenment many health departments have added entomologists to their staffs. The United States Public Health Service now has entomologists as commissioned officers in the regular public health service corps. Previously, such commissions were restricted to medical men and to engineers. The Public Health Service has changed one war-time division, namely, Malaria Control in War Areas into a permanent division entitled the Communicable Disease Center, which is located in Atlanta, Ga., and at this Center particular emphasis is placed upon the study of diseases transmitted by insects as well as diseases resulting from insanitary conditions.

As a result of the dengue epidemic in Honolulu in 1943, the Department of Health of the Territory of Hawaii established the position of medical entomologist in the Division of Sanitation in 1945. This is a position in addition to the position of chief of the Bureau of Mosquito Control. The medical entomologist has been charged with the task of preparing a complete bibliography on the insects and other arthropods of medical importance found in the Territory. This is far from complete but will serve as the basis for our discussion at this time. A brief review of this subject has been previously presented by Pemberton (1943).

An arthropod is of interest to the medical entomologist, if it can be included in one or more of the following categories:

| | |
|---|---|
| *A. Vectors of Disease* | |
| 1. Biological transmission through bite or faecal contamination. | Malaria, dengue, plague, typhus, etc. |
| 2. Mechanical transmission through food contamination. | Dysenteries, etc. |
| *B. Production of Pathological Condition* | Scabies, head louse, etc. |
| *C. Stinging or Biting Arthropods* | Mites, spiders, ants, wasps, scorpions, etc. |

Many insects will fall into two or more classifications depending upon the presence or absence of diseases, which they can transmit. Many insects, such as the bedbug, *Cimex lectularius* Linn. must be included because of their close association with man, even though they are not known to transmit disease. Such insects must be considered suspects in possible insect-borne diseases. The question of animal reservoirs must also be kept in mind, although it will be necessary to exclude a discussion of this important problem from this paper.

## Insects of Medical Importance

*Siphonaptera*

This group contains the most important insect vectors of disease in the Territory. The principal information is found in the work of Eskey (1934) who worked on the local epidemiology of bubonic plague. *Xenopsylla cheopis* (Rothschild) is found throughout the Islands and is the classic vector of plague. This species is also incriminated as a vector of endemic typhus fever. As a result of Eskey's work, a species of flea new to science was discovered on the local rat, *Rattus hawaiiensis*. This species was described by Jordan (1932) as *Xenopsylla hawaiiensis* and has since been synonymized by Augustson (1947) with *Xenopsylla vexabilis* Jordan, described from Australia. This synonymy is of considerable importance since the Hawaiian rat has been considered the principle reservoir of plague in the Islands and the fleas associated with them are responsible for plague transmission. Eskey was able to transmit plague with *X. hawaiiensis* (=*X. vexabilis*) in one experiment and further reported that this species outnumbered *X. cheopis* two to one in the plague area of the island of Hawaii. Eskey has shown that rats obtained from within buildings show a higher infestation of *Xenopsylla cheopis* than rats taken outside of buildings. He has also shown that it was possible to culture *X. cheopis* without the addition of grass cuttings, essential in the culture of *X. hawaiiensis* (= *X. vexabilis*). Apparently, *X. cheopis* prefers to breed within the shelter of buildings, while *X. hawaiiensis* (= *X. vexabilis*) may be considered to be

much more of a field flea. The continuous smoldering of plague amongst the field rodents of Hamakua, Hawaii, and Makawao, Maui, with occasional human cases may be the result of different rates or degrees of transmission by these two species. This is a problem which needs much further investigation. *Nosopsylla fasciata* (Bosch), the northern rat flea, is found principally at higher elevations in the Territory. In the Kula region of Maui 44 per cent of the rats trapped above an elevation of 2,500 feet were found to be infested with this species (Eskey 1934). *Leptopsylla segnis* (Schönherr) is also prevalent at these higher elevations. Neither of these species is believed to be involved in the transmission of plague in the Territory.

*Ctenocephalides felis* (Bouché) is the most common flea in the Territory and is found on cats, dogs, mongoose, rats and it occasionally bites man. Large outbreaks of this flea occur from time to time particularly upon removal of a cat or a dog and usually following periods of dry weather. This species has recently been incriminated in the transmission of typhus fever (Irons *et al.* 1944).

*Pulex irritans* Linn., the human flea, has been occasionally found in Hawaii, principally on dogs, and rarely on rats. It is not considered an important problem in the Territory. Both *Pulex irritans* and *Ctenocephalides canis* have been investigated recently in relation to the transmission of *Salmonella enteritidis* (Varela and Olarte 1946).

*Echidnophaga gallinacea* (Westw.). The sticktight flea is quite common in the Territory on chickens, dogs, cats, pigs, mongoose and rats. Wheeler, *et al.* (1941) has recently reported this species as being found naturally infected with plague. Illingworth (1916) has studied this species in Hawaii and has shown that the life cycle from egg to adult is approximately three weeks. From a half pint of dried dirt from the floor of an infested hen house, he collected a total of 1,027 fleas. This species has been shown by Alicata (1942) to be capable of transmitting endemic typhus fever, and Brigham (1941) reported the recovery of typhus from naturally infected *E. gallinacea.*

There are many features in the life history, ecology, behavior, and general distribution of fleas which we would like to know in order to be able to plan plague and typhus control programs more efficiently. In the past, it has been believed that plague could be controlled entirely by the control of the rodents. It is now realized that one must approach the problem from all aspects and that the fleas responsible for transmission of plague and typhus must be studied and controlled.

*Diptera*

The next group of insects to be considered from the standpoint of health in the Territory are the Diptera. The most important members of this group are the mosquitoes of which there are three species in the Territory. Usinger (1944) has reviewed the biology and Bonnet (1947) has discussed the breeding container distribution for these species in Hawaii.

*Aedes aegypti* (Linn.). This species is the classic vector for yellow fever. It is also a vector for dengue fever, filariasis, and possibly a vector for the encephalitides, and lymphocytic choriomeningitis. This species is highly domesticated and is usually found breeding in all types of artificial containers. Its distribution is much more limited than that of the other species, and it is usually restricted to the warmer, drier areas of the Islands (Bonnet, 1945).

*Aedes albopictus* (Skuse) is a proven vector of dengue fever (Simmons, St. John, and Reynolds, 1930) and has also been demonstrated in the laboratory as capable of transmitting yellow fever (Snijders, 1931). This species is widely distributed in the Hawaiian Islands being found at both low and high elevations. It is found in artificial containers along with *Aedes aegypti* but is also commonly found in natural containers such as treeholes, rock holes, and water-holding plants. The flight range of this species in Hawaii has been reported as usually less than 200 yards (Bonnet and Worcester, 1946).

*Culex quinquefasciatus* Say. This species is by far the most abundant and the most annoying of the mosquitoes in Hawaii. It commonly breeds in ground pools, swamps, and irrigation ditches, as well as in artificial containers. It is particularly abundant in waters of high organic content such as sewage effluents and run-off from pig and dairy farms. This species is a known vector for filariasis (*Wuchereria bancrofti*) in the West Indies; although a few human carriers are known to be present in the Territory, no case of locally acquired filariasis is known. Recent experiments by the Army (Webb, 1946) in the Territory of Hawaii have demonstrated that the local *Culex* will, when infected, permit the filarial worm to develop to the infectious state. Apparently, there is too small a reservoir of infected humans to permit this abundant mosquito to become infected frequently enough to effect transmission.

At the present time there are no *Anopheles* mosquitoes, the vector for malaria, in the Territory of Hawaii. However, human malaria carriers are present in significant numbers and the successful establishment of malaria mosquitoes would produce a devastating effect upon the health and economy of the Islands.

*Musca domestica* Linn. The common house fly present in the Territory may not be the *Musca domestica* of Europe and North

America. Illingworth (1923) has shown that the specimens found locally appear to be an intermediate form between *Musca domestica* and *Musca vicina* Macquart. These flies breed in all types of manure and rotting organic matter and at times are a considerable problem around houses and in restaurants. Recent studies (Pipkin, 1942) have shown an interesting relationship between flies and dysentery. House flies fed upon cultures containing cysts of *Entamoeba histolytica* selectively ate the cysts in preference to other food items. These cysts then passed through the intestinal tract of the fly and were still viable. Apparently, the cysts were of a size favorable for ingestion by the fly. Because of the habit of the fly, of defecating while feeding, a positive means of distribution is present, rather than the haphazard mechanical transmission such as that of the amoebic cysts sticking to the legs or body. It is probable that this phenomenon also has significance in the transmission of the bacillary dysenteries.

The correct identification of the common house fly in Hawaii is of considerable interest since the habits of *Musca domestica* are reported to be quite different from *Musca vicina.* Chang (1943) states that the latter species does not frequent human faeces but prefers cooked vegetable refuse, and hence in China is known as the "rice fly." Negative results were obtained by Chang when the gut contents of *Musca vicina* were examined for human intestinal parasites, although *Chrysomia megacephala* (Fabr.) and *Lucilia sericata* (Meigen) were both shown as positive carriers of *Entamoeba histolytica.*

There are present in the Territory various flies which may be involved in myiasis, the principal one being *Hermetia illucens* (Linn.) which was first reported in Hilo, Hawaii, around 1930 (Williams, 1933), and is now widely distributed. The blow flies *Chrysomyia megacephala* and *Lucilia sericata* are potent food contaminators due to their habit of breeding in filth and feeding on sweets (Chang 1943). They may also be involved in cases of human myiasis. The former species is believed to have been accidentally introduced into the Territory around 1900 (Perkins 1913, *vide* Bryan 1934).

There are a number of biting flies present such as *Stomoxys calcitrans* (Linn.) and *Haematobia irritans* (Linn.) which are normally associated with horses and cattle but which may occasionally attack man. Although these species are not known to transmit disease to man, it is within the realm of possibility that they do, because of their biting habits; they cannot be overlooked, particularly in view of the presence of equine encephalitis in horses and Q-fever in cattle, which are pathogenic to humans.

*Orthoptera*

Mention should be made of the cockroaches found in the Territory since they are frequently incriminated in the mechanical transmission of the dysenteries. *Periplaneta americana* (Linn.) and *Periplaneta australasiae* (Fabr.) are frequently found in restaurants and homes, and can always be collected from just inside the tops of cesspools and sewer man-holes. *Leucophaea maderae* (Fabr.) is readily collected from chicken coops and pig farms where they are often present in tremendous numbers. The small cockroach *Blattella germanica* (Linn.) a common inhabitant of homes and stores is often confused with *Blattella lituricollis* (Walker) which is also present. *Supella supellectilium* (Serville), a common household pest in the tropics, is also present. Illingworth (1915) calls attention to the former medicinal uses of cockroaches in dropsy, whooping cough and Bright's disease and the external application of cockroach oil as a cure for warts.

*Hemiptera*

Among the Hemiptera, there are two species that attack man in the Territory. The bedbug, *Cimex lectularius,* is a common inhabitant of tenements, hotels, and "flop houses". It may also be found in chicken houses. Although the bedbug has been frequently considered as a possible vector for many different diseases, there is no positive evidence that it is responsible for transmitting any disease. This is one pest against which DDT is extremely effective, and it may be possible that complete extermination will result.

*Triatoma rubrofasciata* (DeGeer) is the largest blood-sucking insect in the Territory. Although it is known as a possible vector of Chagas' disease (South American trypanosomiasis), this disease has not been reported in Hawaii. *Trypanosoma cruzi* Chagas, the etiological agent for Chagas' disease, may be easily confused with *Trypanosoma conorhini* Donovan, the latter having been reported in *Triatoma rubrofasciata* from Oahu (Wood 1946).

*Anopleura*

Head lice, *Pediculus humanus* var. *capitis* DeGeer, and crab lice, *Phthirus pubis* Linn., are both known in Hawaii, but are not known to transmit any disease locally. The head louse produces a local irritation of the scalp which may become quite severe. Ten per cent DDT dust has proven extremely effective in the control of the louse and the Department of Health in collaboration with the Department of Public Instruction has instituted a program of control for head lice in school children.

*Hymenoptera*

There are numerous insects including the honey bee, *Apis mellifica* Linn. and *Polistes macaensis* (Fabr.) and others which sting

and produce more or less severe local reactions. Special mention should be made of the fire ant, *Solenopsis geminata rufa* (Jerdon) which is found on Oahu and Hawaii. The name is derived from the fiery sting, which is hard to believe can be produced by such a small insect. It is interesting to note that bee stings have been used for the relief of arthritic conditions (Guyton 1947).

*Miscellaneous*

*Arthropods of Medical Interest.* A number of arthropods other than insects are present which sting or bite or are vectors of disease and hence are of medical importance.

Mention must be made of the centipedes, *Scolopendra subspinipes* Leach and *Otostigmus scaber* Porat, the scorpion, *Isometrus maculatus* DeGeer, and the black widow spider, *Latrodectus mactans* (Fabr.) which are capable of producing severe symptoms of poisoning by their bites or stings. Also present in Hawaii is *Latrodectus geometricus* Koch, a less poisonous, closely-related form frequently mistaken for the less abundant *Latrodectus mactans*. Both of these spiders are highly parasitized by a small wasp (*Eurytoma* sp.) (Bianchi 1947).

Occasional complaints are received relative to the bites and irritations from mites. Usually, these are caused by the bird mite, *Liponyssus bursa* (Berlese) or occasionally by the grocer's itch mite, *Tyroglyphus* sp. *Laelaps nuttalli* Hirst (=*Laelaps hawaiiensis* Ewing) has been incriminated as a possible vector of endemic typhus fever (Rumreich and Koepke 1945), while the rat mite, *Bdellonyssus bacoti* (Hirst) (= *Liponyssus bacoti* [Hirst]) and *Polyplax spinulosus* (Burmeister) are known to transmit endemic typhus fever among rodents (Dove and Shelmire 1931, Mooser, Castaneda, and Zinsser 1931). The human itch mite, *Sarcoptes scabiei* (Linn.) is also found in the Territory. Many diseases have been demonstrated to be transmitted by ticks, such as Rocky Mountain spotted fever, tick-borne relapsing fever, Q-fever, tick bite fever and tularemia. Hawaii is fortunate, however, in having only two ticks, the dog tick *Rhipicephalus sanguineus* (Latreille) and the spinose ear tick of cattle, *Ornithodoros megnini* (Dugés). Although neither of these ticks regularly attacks man, the former species has been incriminated as a possible vector of most of the tick-borne diseases.

Although not generally included in lists of medically important arthropods, mention should be made of the presence in Hawaii of several species of fresh-water copepods of the genus *Cyclops*, including *Cyclops prasinus, strenuus* and *serrulatus*. These have all been incriminated as intermediate hosts for various parasitic worms, including *Dracunculus medinensis, Diphyllobothrium latum, D. mansoni, D. houghtoni, Drepanidotaenia lanceolata* and *Gnathostoma spinigerum* (Craig and Faust 1943).

## Conclusion

A review of the arthropods found in Hawaii indicates no lack of vectors for most of the known insect-borne diseases. Most of these vectors have been introduced into the Territory of Hawaii during the last one hundred years. Hawaii has been more fortunate than many areas in lacking either the vector or the disease as a result of its insular position. This feature of "insular protection" is a thing of the past. Fast ship and airplane travel can bring persons to the Islands, well within the incubation period of most diseases. This means a person infected with an illness in China, the Philippines, or anywhere in the world, may arrive in Hawaii before the onset of the disease. At the present time, no place is further than seventy-two hours distant and this "time-distance" is rapidly diminishing. The probability of new diseases that are insect-borne being discovered is high-lighted by the recent work on the encephalitides (Hammon and Reeves 1947) and the discovery in 1946 of Rickettsial pox in Kew Gardens, Long Island, which is transmitted by the mouse mite, *Allodermanyssus sanguineus* (Hirst) (Huebner *et al.* 1946).

This brief review of the arthropods of medical importance to Hawaii demonstrates the need for constant vigilance. One cannot be complaisant concerning possible invasion by insects which attack plants or transmit plant disease, nor can we ignore the dangers which would result from an invasion by insects that attack man and transmit disease.

## REFERENCES


Alicata, J. E. 1942. Experimental Transmission of Endemic Typhus Fever by the Sticktight Fleas, Echidnophaga Gallinacea. Jour. Washington Acad. of Science, **32**: 57-60.

Augustson, Gustaf F. 1947. Xenopsylla Fleas of the Hawaiian Islands (Siphonaptera: Pulicidae). Proc. Hawaiian Ent. Soc., **13**: 33-36, 1 fig.

Bianchi, F. 1947. Eurytoma on Latrodectus. Proc. Hawaiian Ent. Soc., **13**: 17.

Bonnet, D. D. 1945. Certain Biological Aspects of Mosquito Control in the Territory of Hawaii (Abstract). Proc. Hawaiian Acad. of Science, 19th and 20th Meetings, University of Hawaii.

Bonnet, D. D. and Worcester, D. J. 1946. The Dispersal of Aedes albopictus in the Territory of Hawaii. Amer. Jour. Trop. Med., **26**: 465-476.

Brigham, G. D. 1941. Two Strains of Endemic Typhus Fever Virus Isolated from Naturally Infected Chicken Fleas (Echidnophaga gallinacea). Public Health Reports **56**: 1803-1804.

Bryan, E. H. 1934. A Review of the Hawaiian Diptera, with Descriptions of New Species. Proc. Hawaiian Ent. Soc., **8**: 399-468.

Chang, K. 1943. Domestic Flies as Mechanical Carriers of Certain Human Intestinal Parasites in Cheng tu. Jour. West China Border Research Soc., **14**: 92-98. (In Abstract.)

Craig, C. F. and Faust, E. C. 1943. Clinical Parasitology, 3rd edition.

Dove, W. E. and Shelmire, B. 1931. Tropical Rat Mites, *Liponyssus bacoti* Hirst, Vectors of Endemic Typhus. Jour. Amer. Med. Assoc., **97**: 1506-1510.

Eskey, C. R. 1934. Epidemiological Study of Plague in the Hawaiian Islands. Public Health Bull. 213, U. S. Treasury Dept., Public Health Serv., 1-70.

Guyton, F. E. 1947. Bee Sting Therapy for Arthritis and Neuritis. Jour. Econ. Ent., 40: 469-472.

Hammon, W. McD. and Reeves, W. C. 1947. Interepidemic Studies on Arthropod Borne Virus Encephalitides and Poliomyelitis in Kern County, California, and the Yakima Valley, Washington, 1944. Amer. Jour. Hygiene, 46: 326-335.

Huebner, R. J., Jellison, W. L. and Pomerantz, Charles. 1946. Rickettsial Pox—A Newly Recognized Rickettsial Disease. IV. Isolation of a Rickettsia Apparently Identical with the Causative Agent of Rickettsial Pox from *Allodermanyssus sanguineus*, a Rodent Mite. Public Health Reports, 61: 1677-1682.

Illingworth, J. F. 1915. Use of Cockroaches in Medicine. Proc. Hawaiian Ent. Soc., 3: 112-113.

Illingworth, J. F. 1916. Notes on the Hen Flea ("Echidnophaga gallinacea" Westw.). Proc. Hawaiian Ent. Soc., 3: 252-254.

Illingworth, J. F. 1923. House-Flies. Proc. Hawaiian Ent. Soc. 5: 275-276.

Irons, J. V., Bohls, S. W., Thurman, D. C., Jr. and McGregor, T. 1944. Probable Role of the Cat Flea, Ctenocephalides felis, in Transmission of Murine Typhus. Amer. Jour. Trop. Med., 24: 359-362.

Jordan, K. 1932. A New Xenopsylla from Hawaii. Novitates Zoologicae, 38: 264-266.

Mooser, H., Castaneda, M. R. and Zinsser, H. 1931. The Transmission of the Virus of Mexican Typhus from Rat to Rat by Polyplax spinulosus. Jour. Expt. Med., 54: 567-575.

Pemberton, C. E. 1943. Insects and Other Arthropods of Medical Interest in Hawaii. Hawaii Med. Jour., 2: 191-193.

Perkins, R. C. L. 1913. Fauna Hawaiiensis, Vol. I, Part 6, Review of Diptera: 180-189.

Pipkin, A. C. 1942. Filth Flies as Transmitters of Endamoeba Histolytica. Proc. Soc. Expt. Biol., 49: 46-48.

Rumreich, A. S. and Koepke, Jean A. 1945. Epidemiological Significance of Seasonal Variations in Rodent-Ectoparasite Distribution. Public Health Reports, 60: 1421-1428.

Simmons, James S., St. John, J. H. and Reynolds, F. H. K. 1930. Dengue Fever Transmitted by Aedes albopictus, Skuse. Amer. Jour. Trop. Med., 10: 17-21.

Snijders, E. P. 1931. The Yellow Fever Problem in the Far East. Trans. 8th Congress held in Siam, December, Far Eastern Assoc. of Trop. Med., 1: 133-150.

Usinger, Robert L. 1944. Entomological Phases of the Recent Dengue Epidemic in Honolulu. Public Health Reports, 59: 423-430.

Varela, Gerardo and Olarte, J. 1946. Transmission of Salmonella Enteritidis by Pulex irritans and Ctenocephalus canis. Science, 104: 104-105.

Webb, J. 1946. Personal communication.

Wheeler, C. M., Douglas, J. R. and Evans, F. C. 1941. The Role of the Burrowing Owl and the Sticktight Flea in the Spread of Plague. Science, 94: 560-561.

Williams, F. X. 1932. Entomological Note. Proc. Hawaiian Ent. Soc., 8: 232.

Wood, Sherwin. 1946. The Occurrence of Trypanosoma conorhini Donovan in the Reduviid Bug, Triatoma rubrofasciata (DeGeer) from Oahu, T. H. Proc. Hawaiian Ent. Soc., 12: 651.

# The Carabid Tribes Harpalini, Lebiini and Bembidiini in Hawaii (Coleoptera)

By EVERARD B. BRITTON
Department of Entomology, British Museum (Natural History)
(*Presented by E. C. Zimmerman at the meeting of December 8, 1947*)

The works of Blackburn and Sharp established the greater part of the species of Hawaiian Carabidae, but identification has remained an impossibility without reference to the original series. As the types of the species described by both Blackburn and Sharp are in the British Museum, I have undertaken a revision of the carabid fauna of the Islands. The Nomiini have been the object of a special report recently published by Bishop Museum (Bishop Mus. Occ. Papers, **19** (4) : 107-166, figs. 1-17, 1948). Work is now in progress on the remaining tribe, the Anchomenini.

I wish to express my thanks to Mr. E. C. Zimmerman for collaboration and advice, and for his care in the preparation of this paper for the press. It was at his suggestion that this work was begun, and in 1938 he turned over to me his manuscript revision of the Hawaiian Carabidae which he was unable to complete because of the lack of types in Honolulu.

The extreme isolation of the Hawaiian Islands is clearly reflected in the carabid fauna. Of the fifty or more tribes of Carabidae which are recognized, only five are represented in the Islands, and only three have existed there long enough to permit the evolution of endemic species. The tribes with endemic species are the Bembidiini, Nomiini and Anchomenini. The Nomiini and Anchomenini, which are not dealt with here, each comprise a single genus with a large number of species, all of which are endemic. The Bembidiini on the other hand, include five genera and 26 species, of which 19 are probably endemic. Of the four species of *Tachys,* one has been introduced from southeast Asia, one from the West Indies or Central America, while the other two have not yet been recognized outside the Islands. It is, however, unlikely that they are endemic. The two species, *Lymnastis swaluwenbergi* Jeannel and *Typhlonesiotes swaluwenbergi* Jeannel, minute insects found in cultivated soil, were probably introduced in soil attached to plants. The two species of *Gnatholymnaeum* are probably endemic, and have their nearest relatives in the Holarctic Region, and especially on the western coast of North America. Of the 18 species of *Bembidion,* all but one appear to be endemic, but it seems probable that *Bembidion* has existed in the Islands for a shorter time than the Nomiini and Anchomenini, which have radiated into a far greater number of species.

KEY TO THE TRIBES OF HAWAIIAN CARABIDAE

1. Head with one seta above each eye, and that situated between middle and posterior margins of eye.....**Harpalini.**
Head with two setae above each eye, anterior seta situated at or beyond middle of eye or close to its anterior margin, posterior one situated at a distance from inner margin and above posterior margin or slightly behind it..... 2

2(1). Elytra truncate behind; claws serrate beneath.....**Lebiini.**
Elytra entire, rounded behind; claws simple..... 3

3(2). Outer hollow (scrobe) of mandible bearing a single bristle..... 4
Scrobe of mandible with no bristle.....**Anchomenini.**

4(3). Terminal segment of palpi minute or styliform, not similar to penultimate segment; two basal segments of anterior tarsi in male asymmetrically expanded, each with a tooth on anterior edge; apical emargination of elytra without an inner fold.....**Bembidiini.**
Terminal segment of palpi similar in size to penultimate segment; never unusually small; three or four basal segments of anterior tarsi in male slightly and symmetrically expanded, without a tooth on anterior edge; an inner longitudinal fold of elytra becoming visible externally in apical emargination.....**Nomiini.**

## HARPALINI

### Genus STENOLOPHUS Dejean

**Stenolophus limbalis** LeConte.

*Stenolophus limbalis* J. LeConte 1860, Reports Explor. & Surveys railr. route Mississippi River to Pacific Ocean **9**: 28, 1860 (Sept. 1857).

Oahu: introduced from California.

## LEBIINI

### Key to the Genera

1. Pronotum with many setae around margins and on disc; elytra finely and densely pubescent.....**Endynomena.**
2. Pronotum with one seta before middle and one near hind angle only; elytra not pubescent.....**Plochionus.**

### Genus ENDYNOMENA Chaudoir

*Endynomena* Chaudoir, Mon. des Callidides, Ann. Ent. Soc. Belg. **15**: 186, 1872.

**Endynomena pradieri** (Fairmaire).

*Plochionus pradieri* Fairmaire, Rev. Mag. Zool. (2) **1**: 34, 1849. Chaudoir, Ann. Ent. Soc. Belg. **15**: 186, 1872.

*Saronychium inconspicuum* Blackburn, Ent. Mon. Mag., **14**: 142, 1877.

*Endynomena hubneri* Fairmaire, Pet. Nouv. Ent. **2**: 286, 1878.

*Thyreopterus paroecus* Csiki, Denkschr. Akad. Wiss. Wien, Math.-Naturw. K. **91**: 164, 1915.

*Length:* 9 mm. *Colour:* entirely reddish brown. *Head:* flattened; eyes projecting, hemispherical; mandibles very strongly curved. *Pronotum:* cordiform, sides sinuate before posterior angles which are obtuse and blunt; lateral margins wide and flattened; basal depressions shallow. *Elytra:* flattened, widest at a point about one-quarter from apex; striae not impressed, intervals slightly convex, seventh and ninth with a series of large setiferous punctures. Head, pronotum, elytra, legs and antennae strongly pubescent. Hind wings fully developed.

Recently introduced. Widespread from India through the Pacific.

### Genus PLOCHIONUS Dejean

*Plochionus* Dejean, Species general des Coleopteres de la Collection de M. le Compte Dejean, p. 250, 1825.

#### Key to the Species

1. Third and fourth segments of hind tarsus subequal in size and shape, or third but slightly longer, second only about one-third longer than broad; apices of elytra slightly obliquely truncate and forming a distinct, broad, flat triangle with suture at apex; teeth on claws short.....**pallens** Fabricius.
2. Third segment of hind tarsus distinctly longer than fourth, second segment fully twice as long as broad; apices of elytra more squarely truncate and not at all triangular; teeth on claws long .....**timidus** Haldeman.

**Plochionus pallens** Fabricius.

*Plochionus pallens* Fabricius, Systema Ent. p. 244, 1775.

*Plochionus bonfilsi* Dejean, Spec. gen. des Col. de la col. de M. le Comte Dejean, p. 251, 1825.

*Plochionus valens* J. LeConte, Smith, misc. coll. 6 (167): 5, 1863.

*Length:* 8 mm. *Colour:* entirely reddish brown. *Mandibles:* strongly curved; eyes projecting, hemispherical. *Pronotum:* quadrate, sides straight, not sinuate in front of posterior angles which are slightly obtuse but sharp. *Elytra:* flattened and obliquely truncate at apex; striae well-marked, unpunctured; intervals slightly convex, third with two setiferous punctures near third stria. Legs pubescent. Hind wings fully developed.

Introduced by shipping; almost cosmopolitan.

**Plochionus timidus** Haldeman.

*Plochionus timidus* Haldeman, Proc. Acad. Nat. Sci. Phila., 1: 298, 1843.

*Length:* 7-8 mm. *Colour:* uniform dark brown; margins of pronotum and elytra translucent. *Pronotum:* with sides strongly rounded and hind angles slightly obtuse; ratio greatest width length = 1.4. *Elytra:* as in *P. pallens* but with apices more squarely truncate.

A recent introduction from North America. Recorded there as an effective predator on larvae of the web-worm moth (*Hyphantria cunea*) (Murtfeldt, Canad. Ent. 24: 279, 1892). Larval state lasts approximately 16 days, with three moults (Duffey, Trans. Acad. Sci. St. Louis, 5: 533, 1892).

## BEMBIDIINI

### Key to the Genera

1. Elytral striae obsolete on sides, only first two or three near suture distinct; first stria continued along hind margin and then recurved to form an arcuate groove at about middle of posterior part of each elytron; fore tibiae with outer margin obliquely cut off at apex ..... **Tachys.**
   Elytral striae not so developed, without a subapical recurved stria ..... 2
2(1). Head, pronotum and elytra with coat of fine setae throughout ..... **Lymnastis.**
   Elytra and pronotum not setose throughout ..... 3
3(2). Less than 1 mm. long; one blind soil-inhabiting species ..... **Typhlonesiotes.**
   More than 2 mm. long; eyes always present, but sometimes reduced ..... 4
4(3). Mandibles elongate, narrow and dagger-like, projecting beyond labrum for a distance distinctly greater than length of clypeus and labrum combined; posterior supraorbital seta situated well behind eye; the fourth segment of anterior tarsus with two curved spines beneath, as long as terminal segment; anterior tibiae longitudinally grooved ..... **Gnatholymnaeum.**
   Mandibles not so elongated; posterior supraorbital seta situated close to hind margin of eye; fourth segment of anterior tarsus without spines beneath; anterior tibiae not grooved ..... **Bembidion.**

### Genus TACHYS Stephens

*Tachys* Stephens, Ill. British Ent. Mandib. 2: 24, 1828. Sharp, Fauna Hawaiiensis 3: 287, 1903.

Genotype: *Tachys scutellaris* Stephens.

### Key to the Hawaiian Species

1. Elytra with only sutural stria distinct; posterior angles of pronotum obtusely rounded; testaceous ..... **atomus** Blackburn.
   Elytra with two or three distinct striae; posterior angles of pronotum acute ..... 2
2(1). Elytra with three distinct striae; subparallel (fig. 2); testaceous ..... **ceylanicus** (Nietner.)
   Elytra with only two distinct striae ..... 3
3(2). Eyes large and strongly convex; elytra sometimes with obscure yellow humeral and subapical spots; microsculpture of pronotum very strong; piceous-black; elytra subparallel (fig. 2) ..... **oahuensis** Blackburn.
   Eyes small and only slightly convex; reddish brown, unicolorous; microsculpture of pronotum very faint or absent, surface shining; elytra ovoid (fig. 2) ..... **arcanicola** Blackburn.

**Tachys atomus** Blackburn.

*Tachys atomus* Blackburn, Ent. Mon. Mag., **15**: 158, 1878.

*Lymnastis capito* Bates, Biologia Centrali-Americana, Col. (1): 287, 1884, *new synonym.*

*Length:* 1.10 mm. *Colour:* pale testaceous, including clypeus and labrum; head rather darker. *Head:* very large, almost as wide as pronotum; eyes small and pigmented; hind wings fully developed.

Oahu: "Not rare in mountain localities at about 1,500 ft." (*Blackburn*). Four examples.

*Tachys atomus* is identical with that described by Bates as *Lymnastis capito* from Guatemala. This species is certainly not a *Lymnastis*. It has been transferred to *Micratopus* by Jeannel (Soc. Ent. France, Livre du Centenaire, p. 168, 1932). In *Micratopus* however, the sutural stria of the elytra is not recurved at the apex, and the mentum has no tooth in the emargination. The unique type of *L. capito* Bates shows a very distinct recurved stria and the mentum has a strong tooth in the middle. The species cannot therefore be retained in *Micratopus*. I refer it provisionally to the genus *Tachys*, and *T. atomus* Blackburn will therefore need no change of genus. *T. capito* Bates was taken by G. C. Champion at San Geronimo. Guatemala, a locality only 15 miles from the Pacific Coast, and has since been discovered in Cuba.

**Tachys ceylanicus** (Nietner) (fig. 2).

*Bembidium ceylanicus* Nietner, Ann. Mag. Nat. Hist. (3) **2**: 423, 1858.

*Tachys flaviculus* Motchulsky, Etudes Ent. **8**: 39, 1859.

*Tachys anceps* Putzeys, Ann. Mus. Civ. Genova **7**: 742, 1875.

*Tachys muscescens* Blackburn, Ent. Mon. Mag., **15**: 158, 1878, *new synonym*.

*Tachys infans* Bates, Ann. Mag. Nat. Hist. (5) **17**: 154, 1886.

*Tachys ceylanicus* (Nietner). Andrewes, Ann. Mus. Civ. Genova, **7**: 436, 1875.

*Length:* 2.0 mm. *Colour:* body uniformly testaceous, legs and antennae paler. *Elytra:* with three sutural striae deeply impressed, closely punctured, only first stria reaching apex; third interval with two punctures, close to the third stria; remaining striae only very faintly indicated; whole surface shining, without microsculpture. Hind wings fully developed.

Oahu: "In decaying vegetable matter on the plains of Honolulu" (*Blackburn*). One female. A common species throughout southeast Asia.

**Tachys oahuensis** Blackburn (fig. 2).

*Tachys oahuensis* Blackburn, Ent. Mon. Mag. **15**: 158, 1878.

*Length:* 2.4-2.6 mm. *Colour:* head, pronotum and elytra brown or piceous; mouthparts and legs testaceous; antennae with first two segments testaceous, remainder brown. *Elytra:* with only first and second striae impressed, second not reaching apex or base, obsoletely punctured; close on third stria; surface of head, pronotum and elytra with strong isodiametric microsculpture. Hind wings fully developed.

Oahu: "Not uncommon on salt marshes near the sea." (Blackburn.) Six examples. Molokai (E.C.Z.).

*Tachys oahuensis* belongs to the *quadrillum* species group of Andrewes (Ann. Mus. Civ. Genova, **51**: 368, 1925).

**Tachys arcanicola** Blackburn (fig. 2).

*Tachys arcanicola* Blackburn, Ent. Mon. Mag., **15**: 158, 1878.

*Length:* 1.92-2.09 mm. *Colour:* pronotum, elytra, legs, antennae and mouthparts, including labrum and clypeus pale testaceous; remainder of head brown; eyes dark pigmented, reduced, hardly convex. *Elytra:* with only two striae strongly impressed, unpunctured; other striae faintly indicated; two setiferous punctures on fourth interval; one near middle, other near apex opposite middle of apical recurved stria. Microsculpture very faint, stronger on head. Hind wings vestigial. 0.25 mm. long.

Oahu: 1,500 ft., under bark (Blackburn). Three examples, sea-level, July 1893, two examples (*Perkins*).

*Tachys arcanicola* is quite closely related to *T. pallescens* Bates, from Japan. Both belong to the *triangularis* species group of Andrewes (loc. cit. p. 14).

Genus LYMNASTIS Motschulsky

*Lymnastis* Motschulsky, Etudes Entomologiques, **11**: 27, 1862.

*Limnastis* of other authors.

Genotype: *Lymnastis indicus* (Motschulsky).

Subgenus PARALIMNASTIS Jeannel

**Lymnastis (Paralimnastis) zwaluwenburgi** (Jeannel), *emendation.*

*Lymnastis* (*Paralimnastis*) *swaluwenbergi* Jeannel Soc. Ent. France, Livre du Centenaire, p. 176, fig. 12, 1932. (Type of the subgenus.)

*Length:* 2.0 mm. *Colour:* entirely pale testaceous. Eyes minute but slightly convex; sutural angles of elytra differing from all other known species of *Lymnastis* in that they are not rounded and dehiscent, but sharp; three long setae on third interval.

Oahu: Honolulu, three examples found in the subterranean part of an old sugar cane stool (R. H. Van Zwaluwenburg).

The genus *Lymnastis* occurs in southern Europe, North Africa, East Africa, India, Burma, Indo-China, Java, Celebes, Borneo, New Guinea and eastern Australia. According to Jeannel the presence of a species of *Lymnastis* in Oahu proves that at an early geological epoch there were continental connections over the whole western Pacific from the Malay archipelago, as far as the Hawaiian Islands. This is entirely opposed to the usual hypothesis that the Islands are purely oceanic and have never been in connection with any continent. In view of the very convincing evidence that has been accumulated in favor of the view that the Islands are of oceanic origin, Mr. Zimmerman and I see no reason for accepting Dr. Jeannel's statement. *Lymnastis swaluwenburgi,* like *Typhlonesiotes swaluwenbergi* is undoubtedly a relatively recent introduction, and perhaps reached the islands in soil attached to cultivated plants or soil in ships' ballast.

Genus TYPHLONESIOTES Jeannel

*Typhlonesiotes* Jeannel Revue Francaise d'Ent. 3 (4): 323, 1937.
Genotype: *Typhlonesiotes swaluwenburgi* Jeannel.

**Typhlonesiotes zwaluwenburgi** (Jeannel), *emendation.*
*Typhlonesiotes swaluwenbergi* Jeannel, 1937, loc. cit., figs. 155-162. Zimmerman, Proc. Hawaiian Ent. Soc. 10: 132, 1938.
*Length:* 1.0 mm. *Colour:* entirely pale testaceous. *Eyes:* absent.
Oahu: numerous examples taken in the soil at the roots of sugar cane stools (R. H. Van Zwaluwenburg). Thirteen examples.

According to Jeannel this genus is very closely related to *Anillopsis capensis* (Peringuey) from South Africa, and the two can scarcely have diverged from their primitive common stock in spite of the fact that separation must have occurred in the very distant past. Jeannel further states that it is impossible that the Hawaiian species could have been introduced comparatively recently; that there is no evidence that such minute endogenous Carabidae could be introduced by accidental transport. Further, "Their natural habitat in the fissures of damp clay soils, is quite different from that of subterranean species of loose soil and of cultivation, such as *Somoplatus, Somotrichus, Perigona,* etc. which especially lend themselves to passive transport. *Typhlonesiotes* and *Anillopsis* are indigenous and it is necessary to go back to the Jurassic for the attachment of the Hawaiian archipelago, part of the north Pacific landmass to the continent of Gondwana, by way of Australo-Malasia" [translated from the French]. (Loc. cit. p. 361.)

As in the case of *Lymnastis swaluwenbergi,* Mr. Zimmerman and I cannot support these assertions. There is no reason why the accidental introduction of these two minute soil-living species should be any more improbable than that of any other Carabidae. In the past, soil has been introduced quite frequently especially on the roots of plants. Jeannel states that the natural habitat of these species is not in the soil of cultivation, but it must be observed that these species were discovered in such soil.

The fact that the two species were taken in the soil of sugar cane fields makes it probable that their introduction into the Hawaiian Islands was quite recent. The older introduction of cane was made from the East Indies and especially from Java, and in the days before plant quarantine regulations, soil was introduced with the plants.

Genus GNATHOLYMNAEUM Sharp

*Gnatholymnaeum* Sharp, Fauna Hawaiiensis, 3: 276, 1903.
*Nesolymnaeum* Sharp, Fauna Hawaiiensis 3: 277, 1903, *new synonym.*

Distinguished from *Bembidion* by the elongate mouthparts, the position of the posterior supraorbital seta, the presence of two

curved spines on the underside of the fourth segment of the anterior tarsus, and the grooves on the anterior tibiae (see key to the genera).

Genotype: *Gnatholymnaeum blackburni* Sharp.

Key to the Species

1. Elytral intervals strongly convex; eyes reduced in size; colour of head, pronotum and elytra dark brown; each elytron with a paler, obscure subapical spot; elytral striae only faintly punctured towards base; hind wings vestigial (fig. 2)..... **Gnatholymnaeum blackburni** Sharp.
2. Elytral intervals flat; eyes normal in size; colour of head, pronotum and elytra, bluish black; each elytron with an obscure subapical spot; elytral striae strongly punctured, hind wings fully developed..... **Gnatholymnaeum spurcum** (Blackburn).

**Gnatholymnaeum blackburni** Sharp (fig. 2).

*Gnatholymnaeum blackburni* Sharp, Fauna Hawaiiensis **3**: 276, pl. 7, figs. 18, 25, 1903.

*Length:* 4.62-4.95 mm.

Kauai: (*Perkins*), five examples.

**Gnatholymnaeum spurcum** (Blackburn) (fig. 2).

*Bembidium* (*Notaphus*) *spurcum* Blackburn, Ent. Mon. Mag. **17**: 228, 1881.

*Gnatholymnaeum* (*Nesolymnaeum*) *spurcum* (Blackburn) Sharp, Fauna Hawaiiensis, **3**: 277, 1903.

*Length:* 4.1-4.3 mm.

Maui: Haleakala.

*Gnatholymnaeum* is very closely related to *Amerizus*, a North American genus of five species. The two genera are only distinguishable by the fact that the metasternum, metacoxae and abdominal sternites are sparsely pubescent in *Gnatholymnaeum*. These genera are very near *Lymnaeum*, a genus of three species, which extends from western Europe to Japan and the Kurile Islands. *Lymnaeum* shares the following characters: eyes reduced; male genitalia with parameres of approximately equal length, the left with four apical setae (2 long, 2 short), the right with three apical setae (2 long, 1 short); the anterior projection of the metasternum with a distinct margin. *Lymnaeum* differs from *Amerizus* and *Gnatholymnaeum* in having the mouthparts of normal length and in the fact that the median line of the pronotum is not expanded into a channel in the basal third. This channel is, however, very faint in *Gnatholymnaeum*. There can be no doubt that *Gnatholymnaeum* arose from a *Lymnaeum*-like stock of holarctic origin and most probably from a species of *Amerizus* from the Pacific coast of North America.

## Genus BEMBIDION Latreille

*Bembidion* Latreille, Histoire Naturelle Generale et Particulière des Crustaces et Insectes. Paris, p. 82, 1802.

*Bembidium* Stephens, Illustrations of British Entomology, Mandibulata, 2: 2, 29. 1829.

*Nesocidium* Sharp, Fauna Hawaiiensis 3: 280, 1903, *new synonym.*

*Atelidium* Sharp, Fauna Hawaiiensis 3: 284, 1903, *new synonym.*

*Metrocidium* Sharp, Fauna Hawaiiensis 3: 285, 1903, *new synonym.*

Genotype: *Bembidion quadrimaculata* Linnaeus.

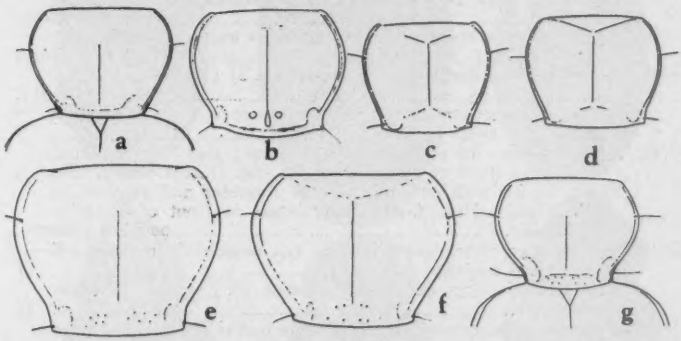


Figure 1.—Outlines of Hawaiian *Bembidion* thoraces: **a**, *B. ignicola* Blackburn; **b**, *B. munroi* (Sharp); **c**, *B.* (*Nesomicrops*) *kauaiensis* (Sharp); **d**, *B.* (*Nesomicrops*) *coecus* (Sharp); **e**, *B. teres* Blackburn; **f**, *B. pacificum* Blackburn; **g**, *B. molokaiense* (Sharp).

### Key to the Hawaiian Species of Bembidion

1. Eyes well developed, convex; length of eye more than 0.18 mm. 2
   Eyes greatly reduced, not projecting; length of eye less than 0.12 mm. (subgenus *Nesomicrops*) ..... 19
2(1). Reticulate microsculpture of surface of head between eyes strong and obvious (at magnification × 60) ..... 3
   Microsculpture absent from head between eyes; surface smooth and shining ..... 10
3(2). Pronotum with microsculpture of surface obvious, especially towards sides, (isodiametric mesh), body form depressed ..... 4
   Pronotum without microsculpture, surface smooth and shining, body form convex ..... 8
4(3). Greater part of elytra yellow, with a dark triangular patch in middle of outer margin extending inward as far as the fifth stria; a dark sutural patch near apex of elytra; antennae with basal two and one-half segments testaceous, remaining segments darker (fig. 2) ..... **advena** Sharp.
   Greater part of the elytra dark brown or aeneous-black in color; with ill-defined paler spots or patches ..... 5

5(4). Elytral intervals quite flat, striae not impressed; pronotum with basal depression on each side obvious, a short carina running to posterior angles ..... **niloticum batesi** Putzeys.
Elytral intervals more or less convex, striae impressed; pronotum with basal depression on each side very small, with no carina near posterior angles ..... 6

6(5). Length 2.7-3.3 mm.; elytra rounded equally sharply at apex and base (fig. 3); color of elytra reddish brown, darker on disc; apex of elytra paler but without a distinct pale spot at apices of intervals 5-8 (Kauai) ..... **rude** (Sharp).
Length 3.7-4.6 mm.; elytra rounded more sharply at shoulders than towards apex; colour of elytra aeneous—brown or black, a distinct pale spot at apices of intervals 5-8 ..... 7

7(6). Pronotum less transverse, ratio greatest width to length less than 1.22 (figs. 1*e*, 3) (Kauai, Oahu, Molokai, Maui) ..... **teres** Blackburn.
Pronotum more transverse, ratio greatest width to length more than 1.25 (figs.. 1*f*, 3) (Kauai) ..... **pacificum** Blackburn.

8(3). Dorsal surface dark metallic green (fig. 3) (Maui) ..... **fulgens** (Sharp).
Dorsal surface uniform brown, or brown with humeral and apical pale spots (Kauai) ..... 9

9(8). Dorsal surface of uniform brown colour; sides of pronotum straight in front of posterior angles (fig. 3) .. **corticarium** (Sharp).
Elytra brown with one pale spot at shoulder and another on apical half; sides of pronotum sinuate in front of posterior angles (fig. 3) ..... **perkinsi** (Sharp).

10(2). Shoulders of elytra quite obvious, not completely rounded off (see fig. 4 *ignicola*) ..... 11
Shoulders of elytra completely rounded off (see fig. 4, *admirandum*) ..... 12

11(10). Sides of the pronotum slightly sinuate just in front of posterior angles (fig. 1*g*); pronotum considerably constricted at base; elytral intervals moderately convex (Molokai, Maui, Kauai) ..... **molokaiense** Sharp.
Sides of pronotum straight, not sinuate in front of posterior angles (fig. 1*a*); pronotum broader at base; elytral intervals strongly convex (fig. 4) (Hawaii) ..... **ignicola** Blackburn.

12(10). Color metallic green or aeneous-black; legs and antennae reddish brown; eyes strongly convex (Oahu, Molokai, Hawaii) ..... 17
Color reddish brown or black; legs testaceous or reddish brown; eyes moderately convex (Kauai) ..... 13

13(12). Length more than 3.4 mm.; sides of pronotum very broadly explanate (fig. 4); shoulders and sides of elytra paler than disc ..... **admirandum** (Sharp).
Length less than 3.0 mm.; sides of pronotum only narrowly explanate; elytra with or without paler shoulders ..... 14

14(13). Head, pronotum and elytra black; antennae unicolourous, dark reddish brown (fig. 4) (Oahu) ..... **atomarium** (Sharp).
Head, pronotum and elytra reddish or aeneous-brown; antennae with base paler than apex (Kauai) ..... 15

15(14). Pronotum with sides straight in front of posterior angles; shoulders of elytra of same colour as disc (fig. 3) (Kauai) ..... **corticarium** (Sharp).
Pronotum with sides distinctly sinuate in front of posterior angles; shoulders of elytra paler in colour than disc (Kauai) ..... 16

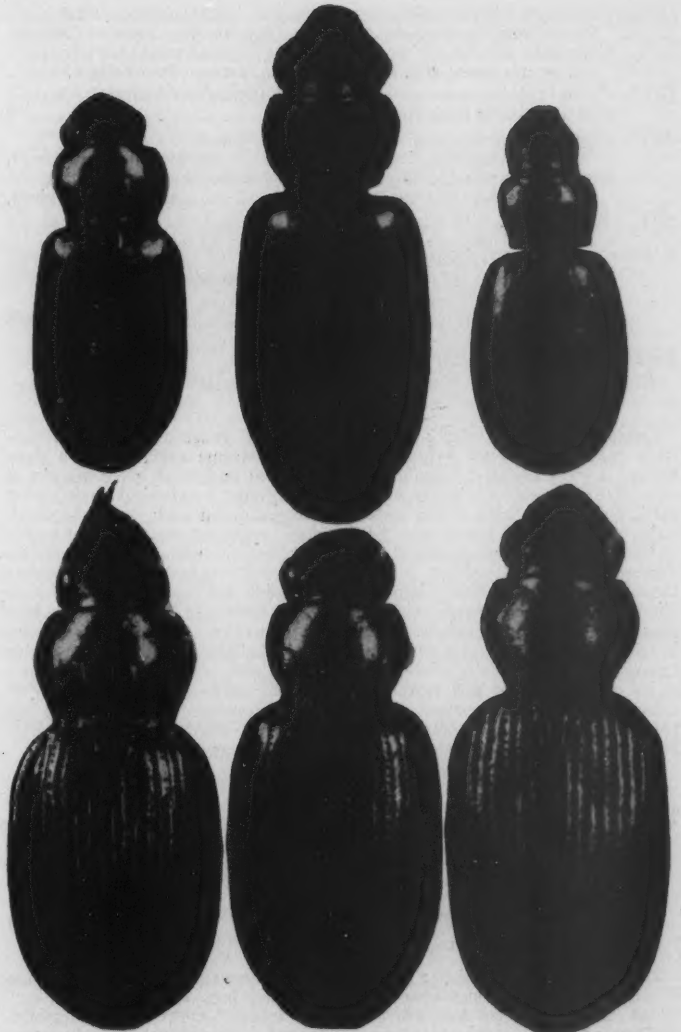

Figure 2.—Hawaiian Bembidiini. Top row, left to right: *Tachys ceylanicus* (Nietner), from the holotype of *Tachys muscescens* Blackburn; *Tachys oahuensis* Blackburn; *Tachys arcanicola* Blackburn. Bottom row, left to right: *Gnatholymnaeum blackburni* Sharp; *Gnatholymnaeum spurcum* (Blackburn), holotype; *Bembidion advena* Sharp, holotype.

16(15). Pronotum with a setiferous puncture at each posterior angle; lateral angles of pronotum wider (figs. 1*b*, 4)..... **munroi** (Sharp).
Pronotum without setiferous punctures; lateral margins of pronotum narrower (fig. 4)..... **munroi brevicolle** (Sharp).

17(12). Colour shining aeneous-black (fig. 5) (Oahu)..... **koebelei** (Sharp).
Colour shining metallic green..... 18

18(17). Elytral striae strongly impressed and punctured; colour metallic green (fig. 5) (Molokai)..... **smaragdinum** (Sharp).
Elytral striae feebly impressed and punctured; colour shining aeneous-green (Hawaii)..... **auratum** (Perkins).

19(1). Eyes larger, 0.10 mm. in length, pigmented; pronotum more contracted at base, ratio greatest width to width at base = 1.42 (fig. 1*c*) (Kauai)..... **kauaiensis** (Sharp).
Eyes smaller, 0.055 mm. in length, unpigmented; pronotum less contracted at base, ratio greatest width to width at base = 1.35 (fig. 1*d*, 4) (Kauai)..... **coecus** (Sharp).

**Bembidion advena** Sharp (fig. 2).

*Bembidion advena* Sharp, Fauna Hawaiiensis 3: 278, pl. 7, fig. 19, 1903.

*Length:* 3.4 mm. *Colour:* head and pronotum aeneous-brown with purplish reflections; elytra bright yellow with extreme outer margins dark brown; a dark brown triangular patch based on middle of outer margin of each elytron, apex of triangle attaining fifth stria; a preapical dark brown patch common to both elytra, extending outwards on each as far as sixth stria; antennae dark brown with the two basal segments and the basal halves of the third and fourth segments testaceous; legs testaceous; mouthparts including the labrum, reddish brown. *Head:* with eyes large and convex; frontal grooves very feebly impressed, extending backwards only as far as middle of eyes; isodiametric microsculpture of surface of head, including clypeus, very strong and obvious. *Pronotum:* transverse; sides slightly sinuate in front of posterior angles which are sharp and slightly obtuse; surface with strong isodiametric microsculpture. *Elytra:* with shoulders rounded off; striae well impressed and regularly punctured, obliterated just posterior to subapical dark patch; scutellary striole well developed; striae 4-7 do not reach basal margin; intervals moderately convex, third with two setiferous punctures. Surface with strong isodiametric microsculpture.

Maui: Haleakala, 5000 ft. (*Perkins*), one example.

**Bembidion niloticum batesi** Putzeys.

*Bembidion niloticum* Dejean var. *batesi* Putzeys, Ann. Soc. Ent. Belg. **18,** Compt.-Rend., p. iii, 1875. Netolitzky, Ent. Blatt., **10**: 167, 1914.

*B. niloticum* Bates, Trans. Ent. Soc. Lond., p. 301, 1873 (not of Dejean).

*Length:* 3.7 mm. *Colour:* dark metallic aeneous-green with the apices of elytra yellowish; mouthparts, antennae and legs brown. *Head:* very broad, with prominent hemispherical eyes, frontal groove deep anteriorly, shallower behind, reaching hind margin of eyes. *Pronotum:* strongly transverse (1.06 mm. × 0.72 mm.), widest just before middle, strongly contracted behind; sides very slightly sinuate in front of posterior angles which are very obtuse (about 130 degrees), but with a small rectangular tooth at apex; a small depression within angle, to apex of which runs a small carina. *Elytra:* with shoulders fairly prominent; striae not impressed to form grooves, but

marked by regular series of well-defined punctures, which disappear in apical quarter; a long scutellary striole present; intervals quite flat, third with two setiferous punctures situated at about one-third and two-thirds of length of elytra from base. Whole surface of head, pronotum and elytra covered with a very strong isodiametric microsculpture.

Oahu, Molokai.

Distribution: *B. niloticum* Dejean, Egypt, Asia Minor; var. *hamatum* Kolenati, Caucasus, Caspian, Turkestan; var. *batesi* Putzeys, China, Japan, Philippines. The Hawaiian form must therefore have been introduced from the oriental region. As the species was not discovered by the earlier collectors it seems likely that it must have been introduced quite recently.

**Bembidion teres** Blackburn (figs. 1*e*, 3).

*Bembidium* (*Lopha*) *teres* Blackburn, Ent. Mon. Mag. **17**: 229, 1881. Sharp, Fauna Hawaiiensis, **3**: 278, 1903.

*Length:* 4.2-4.6 mm. *Colour:* dark aeneous-brown or greenish brown, a faint paler spot near apices of elytral intervals 5, 6 and 7; legs, antennae and mouthparts dark brown. *Head:* with eyes prominent, almost hemispherical; frontal furrows deep and irregular, extending from front of clypeus to a point opposite hind margin of eye, parallel, not converging towards clypeus. *Pronotum:* transverse, widest point just in front of middle (length 0.9 mm., breadth 1.1 mm.); strongly contracted behind, sides slightly sinuate in front of posterior angles which are obtuse but sharply pointed; disc rather flat; side margins flattened, moderately wide, slightly recurved. *Elytra:* with shoulders quite prominent; striae impressed and regularly punctured, disappearing in apical quarter; scutellary striole long; intervals slightly convex, third with two setiferous punctures, situated at about one-third of length of elytra from apex and base respectively. The whole surface has a strong isodiametric microsculpture. Hind wings fully developed.

Kauai, Oahu, Molokai, Maui. (*Blackburn, Perkins.*)

**Bembidion pacificum** Blackburn (figs. 1*f*, 3).

*Bembidium pacificum* Blackburn, Ent. Mon. Mag. **15**: 157, 1878. Sharp, Fauna Hawaiiensis **3**: 279, 1903.

*Length:* 3.4-3.8 mm. *Colour:* head and pronotum dark aeneous-brown to black, elytra aeneous-brown, paler than pronotum; a yellow spot at apices of intervals 5 to 8, connected with pale yellow apices of elytra; base of elytra, including shoulders paler than disc; legs and first two and one-half segments of antennae testaceous; remainder of antennae brown.

Kauai: Waimea Mountains, 4000 ft. May 1894. (*Perkins.*)

Oahu: On damp ground, very local. (*Blackburn.*)

**Bembidion rude** (Sharp), *new combination* (fig. 3).

*Nesocidium rude* Sharp, Fauna Hawaiiensis **3**: 283, 1903.

*Length:* 3.0-3.4 mm. *Colour:* head and pronotum reddish brown; mouthparts and antennae reddish brown, latter with basal segments testaceous; legs testaceous; elytra dark brown with humeral and apical regions and lateral margins paler. *Pronotum:* strongly constricted at base, sides strongly sinuate, posterior angles obtuse but sharp; base roughened, with very strong microsculpture. *Elytra:* with intervals strongly convex, third with two seti-

ferous punctures; striae indistinctly punctured in their basal halves. Margins of the pronotum and elytra reflexed; shoulders completely rounded off.

Kauai: high plateau (*Perkins*).

**Bembidion fulgens** (Sharp), *new combination* (fig. 3).

*Nesocidium fulgens* Sharp, Fauna Hawaiiensis 3: 282, 1903.

*Length:* 2.6 mm. *Colour:* head, pronotum and elytra shining metallic aeneous-green; legs testaceous; antennae brown with two basal segments paler. *Pronotum:* (length 0.62 mm., breadth 0.74 mm.), with sides straight or only very slightly sinuate in front of posterior angles which are obtuse but sharp; base with a few indefinite punctures; surface shining, without microsculpture but somewhat rugose. *Elytra:* with shoulders completely rounded off; intervals convex, the third with two setiferous punctures; striae strongly punctured in basal half.

Maui: Haleakala, 5000 ft. (*Perkins*), three examples.

**Bembidion corticarium** (Sharp), *new combination* (fig. 3).

*Nesocidium corticarium* Sharp, Fauna Hawaiiensis 3: 283, 1903.

*Length:* 2.75-3.10 mm. *Colour:* reddish brown, with mouthparts, legs and antennae testaceous, latter darker towards their apices. *Head:* eyes only moderately convex (see fig. 3). *Pronotum:* strongly constricted at base, sides straight or very slightly sinuate before posterior angles which are obtuse. *Elytra:* ovoid without trace of shoulders; striae slightly impressed in basal half; punctures rather fine and widely separated; intervals slightly convex; third with two setiferous punctures.

Kauai: Waimea Mountains, 4000 ft.; Kaholuamanu (*Perkins*). 1 male, 2 females.

**Bembidion perkinsi** (Sharp), *new combination* (fig. 3).

*Nesocidium perkinsi* Sharp, Fauna Hawaiiensis 3: 282, 1903.

*Length:* 2.8-3.1 mm. *Colour:* head reddish brown; pronotum and elytra dark brown, latter with a pale patch in humeral region extending in as far as fourth stria, and a pale subapical diagonal band extending from margin inwards as far as second stria; antennae brown with first three segments pale, palpi testaceous with penultimate segments brown; legs testaceous. *Pronotum:* with posterior angles very obtuse but sharp; lateral margins very narrow. *Elytra:* markedly convex with very narrow margins; intervals convex, third with two setiferous punctures; striae indistinctly punctured towards base; shoulders completely rounded off.

Kauai: Kaholuamanu, 4000 ft. (*Perkins*).

**Bembidion molokaiense** (Sharp), *new combination* (fig. 1*g*).

*Bembidium* (*Emphanes*) *molokaiense* Sharp, Fauna Hawaiiensis, 3: 279, pl. 7, fig. 23, 1903.

*Nesocidium laeticulum* Sharp, loc. cit., p. 280, *new synonym.*

*Nesocidium lahainense* Sharp, loc. cit., p. 281, *new synonym.*

*Length:* 2.8-3.0 mm. *Colour:* shining aeneous- green, mouthparts, legs and antennae reddish brown, latter darker apically. *Pronotum:* (length 0.64 mm., greatest width 0.77 mm., width at base 0.47 mm.) strongly constricted at base, sides slightly sinuate in front of posterior angles which are obtuse; obscurely rugose at base. *Elytra:* striae strongly punctured in basal half, punctures separated by their own width; intervals strongly convex in basal

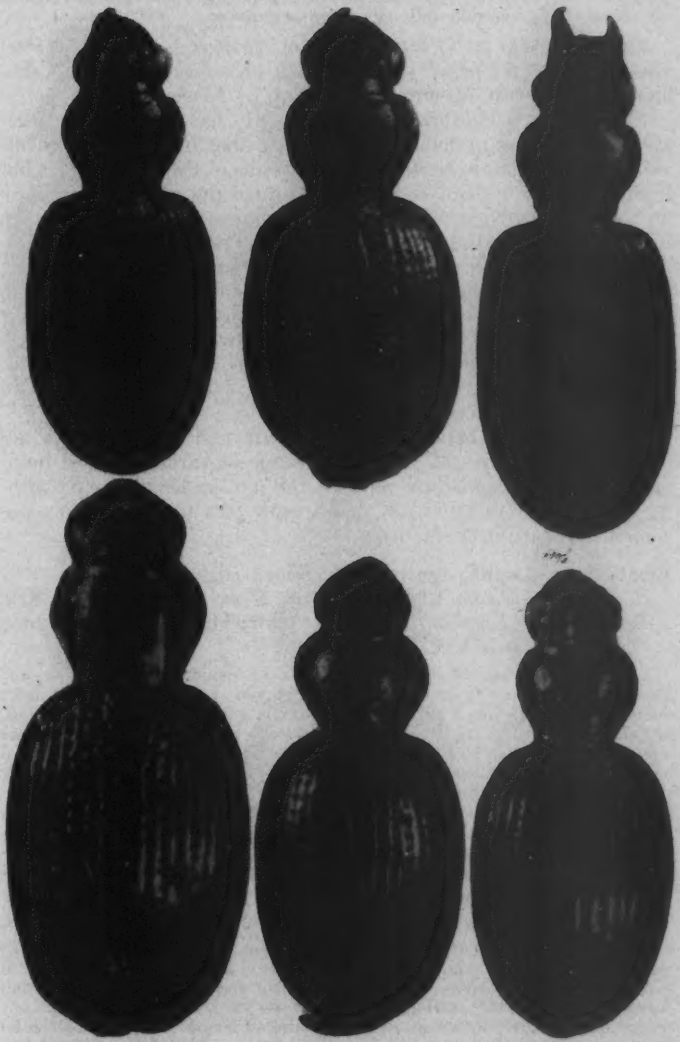

Figure 3.—Hawaiian *Bembidion* species. Top row, left to right: *B. pacificum* Blackburn; *B. rude* (Sharp), paratype; *B. teres* Blackburn. Bottom row, left to right: *B. fulgens* (Sharp), holotype; *B. corticarium* (Sharp), holotype; *B. perkinsi* (Sharp).

half, the third with two setiferous punctures; shoulders not entirely rounded off. Hind wings variable, fully developed or reduced.

Molokai: 4000 ft. (*Perkins*). Maui: Haleakala, 5000 ft. (*Perkins*); Lahaina (*Koebele*); West Maui (*Koebele*). Kauai: Kaholuamanu, Waimea Mountains (*Perkins*). 53 examples.

Sharp (Fauna Hawaiiensis, 1903, p. 281) has discussed the variation in wing size in detail. He suspected that *Bembidion molokaiense* and *Nesocidium laeticulum* were forms of the same species but hesitated to unite them as he had separated the genus *Nesocidium* on the abbreviated wings. Wing dimorphism is, however, known in other beetles. Miss Dorothy Jackson (Trans. Royal Soc. Edinburgh, **55** [III]: 665, 1928) has shown that in the weevil *Sitona hispidula*, the reduced wing is recessive to the normal wing in breeding experiments. In the same work many other examples of wing-dimorphism are given. Further, the two forms of *Bembidion molokaiense* are found together in the same localities and often in the same colonies. In view of these facts, I have no hesitation in establishing the synonymy.

The differences between *N. lahainense* and *N. laeticulum* are very slight and are well within the range of variation. The hind-wings of *N. lahainense* are reduced, 0.8 mm. in length, again within the range of variation of wing length (0.4 mm.–1.2 mm.) observed by Sharp in *N. laeticulum*.

**Bembidium (Lopha) ignicola** Blackburn (figs. 1*a*, 4).

*Bembidion ignicola* Blackburn, Ent. Mon. Mag. **16**: 109, 1879.
*Bembidium* (*Emphanes*) *ignicola* (Blackburn) Sharp, Fauna Hawaiiensis **3**: 279, 1903.

*Length:* 2.70 mm. *Colour:* aeneous-black, mouthparts, antennae and legs reddish brown. *Pronotum:* (length 0.64 mm., greatest width 0.79 mm.; width at base 0.53 mm.) not quite so strongly constricted at base as in *B. molokaiense;* sides straight, not sinuate before posterior angles which are obtuse; base rough. *Elytra:* striae very strongly punctured in their basal halves, punctures separated by less than their own width; intervals strongly convex in basal half, third with two setiferous punctures; shoulders not completely rounded off.

Hawaii: Kilauea (*Blackburn*), one male.

**Bembidion atomarium** (Sharp), *new combination* (fig. 4).

*Nesocidium atomarium* Sharp, Fauna Hawaiiensis **3**: 284, 1903.
*Nesocidium scydmaenoides* Sharp, loc. cit., p. 284, *new synonym.*

*Length:* 2.8 mm. *Colour:* head, pronotum and elytra shining black; mouthparts, antennae and legs reddish brown. *Pronotum:* constricted at base, sides slightly sinuate in front of posterior angles which are obtuse but sharp. *Elytra:* with intervals moderately convex, third usually with one setiferous puncture situated at about one-third of length from base; striae in basal half with strong but widely spaced punctures; shoulders completely rounded off. Microsculpture absent.

Oahu: mountains near Honolulu (*Koebele*); back of Mt. Tantalus on *Pipturus* (*Perkins*), one male, one female.

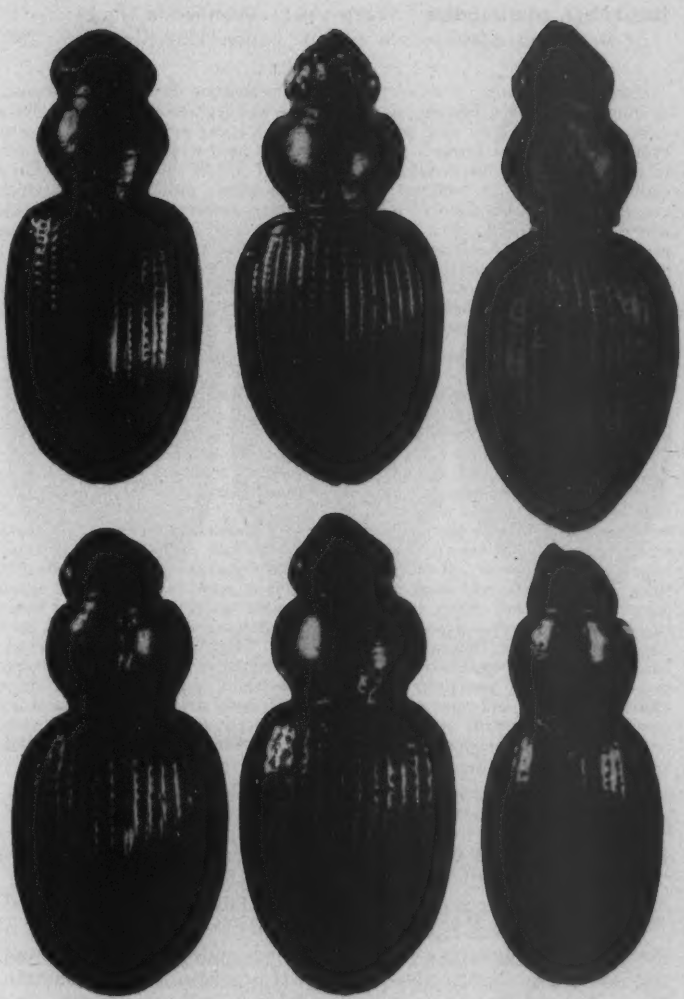

Figure 4.—Hawaiian *Bembidion* species. Top row, left to right: *B. ignicola* Blackburn; *B. admirandum* (Sharp); *B. atomarium* (Sharp). Bottom row, left to right: *B. munroi* (Sharp), holotype; *B. munroi brevicolle* (Sharp), holotype; *B.* (*Nesomicrops*) *coecus* (Sharp), holotype.

**Bembidion admirandum** (Sharp), *new combination* (fig. 4).

*Metrocidium admirandum* Sharp, Fauna Hawaiiensis 3: 286, 1903.

*Length:* 3.9 mm. *Colour:* head and pronotum dark reddish brown, mouthparts including labrum paler; antennae and legs reddish brown; elytra dark reddish brown on disc, paler at sides and apex; epipleura pale brown; ventral surface dark brown. *Pronotum:* ratio base width to greatest width to apex width to middle length, equals 1 to 1.51 to 1.09 to 1.21; sides broadly explanate and slightly reflexed; sides sinuate before posterior angles which are obtuse but sharp pointed; median line finely impressed except near base where it is expanded into a fairly broad depression; base with a transverse groove parallel to posterior margin, and about five punctures on each side; posterior setiferous punctures only are present. *Elytra:* striae strongly impressed throughout most of their length, becoming faint near apex, quite strongly punctured in basal half, punctures becoming fainter towards apex; intervals strongly convex, surface shining, without microsculpture.

Kauai: high plateau, August 1896 (*Perkins*). Holotype only.

**Bembidion munroi** (Sharp), *new combination* (figs. 1*b*, 4).

*Atelidium munroi* Sharp, Fauna Hawaiiensis 3: 285, pl. 7, fig. 22, 1903.

*Length:* 2.8-3.0 mm. *Colour:* head, pronotum and disc of elytra piceous to black, slightly aeneous; mouthparts and antennae dark brown; legs reddish brown; elytra with shoulders, sides (intervals 7-9) and apex yellowish brown; ventral surface piceous except sides of abdomen and elytral epipleura which are yellowish brown. *Head:* rather truncate, frontal grooves deeply impressed. *Pronotum:* strongly convex, lateral margins narrowly reflexed; sides strongly sinuate in front of posterior angles which are obtuse but sharp pointed; middle line finely impressed, becoming wider and deeper at base; base with a transverse groove parallel to basal margin, groove marked by a few faint punctures; lateral depressions deep, longitudinal, slightly curved; base with a slight depression on each side of mid-line, in front of transverse groove; setiferous punctures present at posterior angles. *Elytra:* striae clearly impressed and punctured in basal half, both striae and punctures becoming fainter towards apex, disappearing entirely (except stria one) close to apex; intervals moderately convex. Microsculpture absent. Hind wings vestigial.

Kauai: Waimea, 4000 ft., May, June 1894 (*Perkins*), ten examples.

**Bembidion munroi** variety **brevicolle** (Sharp), *new combination* (fig. 4).

*Metrocidium brevicolle* Sharp, Fauna Hawaiiensis 3: 285, 1903.

This form differs from *B. munroi* s. str. only in the absence of the setiferous punctures of the posterior angles of the pronotum, and in the very slightly narrower reflexed margins of the pronotum. The colour of the 3 examples available is rather immature, but shows the pale sides of the elytra of *B. munroi*. These examples were taken at the same time and in the same place as those of *B. munroi*, and cannot therefore be regarded as a subspecies. They probably represent a mutant which interbreeds with the normal stock. Such forms are common in other Hawaiian Carabidae.

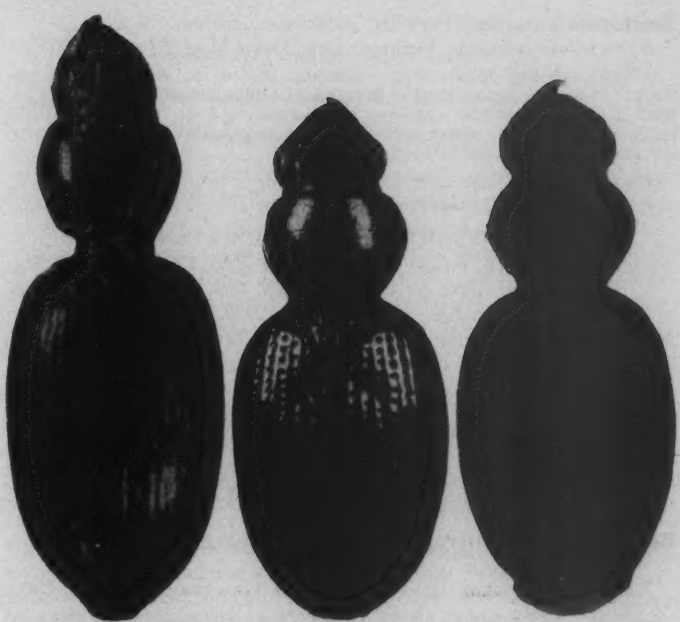

Figure 5.—Hawaiian *Bembidion* species: *B.* (*Nesomicrops*) *kauaiensis* (Sharp), holotype (left); *B. smaragdinum* (Sharp), holotype (middle); *B. koebelei* (Sharp), (right).

**Bembidion koebelei** (Sharp), *new combination* (fig. 5).

*Nesocidium koebelei* Sharp, Fauna Hawaiiensis 3: 282, 1903.

*Length:* 2.7 mm. *Colour:* aeneous-black; appendages reddish brown. Eyes prominent (see fig. 5). *Pronotum:* with sides very slightly sinuate before posterior angles which are obtuse. *Elytra:* ovoid, shoulders completely rounded off; striae moderately impressed and punctured in basal half, punctures separated by two or three times their own width. Intervals slightly convex, third with two setiferous punctures.

Oahu: mountains near Honolulu, 2000-3000 ft. (*Koebele*).

**Bembidion smaragdinum** (Sharp), *new combination* (fig. 5).

*Nesocidium smaragdinum* Sharp, Fauna Hawaiiensis, 3: 282, 1903.

*Length:* 3.1 mm. *Colour:* bright metallic green, appendages reddish brown. Very close to *B. koebelei* (Sharp), but with pronotum slightly more transverse, striae deeper and setiferous punctures on third elytral interval much more strongly impressed.

Molokai: mountains, 4500 ft. (*Perkins*).

**Bembidion auratum** (Perkins), *new combination.*

*Nesocidium auratum* Perkins, Ent. Mon. Mag. **53**: 250, 1917.

*Colour:* shining golden green; antennae reddish at base; legs piceous-black. *Pronotum:* roughened or irregularly sculptured at base. Closely related to *B. smaragdinum* (Sharp), but distinguished on "the comparatively feeble striation of the elytra with rows of finer punctures, which in general are not so closely placed in the rows."

Hawaii: Kilauea.

I have seen no examples of this species.

Subgenus NESOMICROPS (Sharp), new combination

*Nesomicrops* Sharp, Fauna Hawaiiensis **3**: 286, 1903. Jeannel, Soc. Ent. France, Livre du Centenaire, p. 169, 1932. Zimmerman, Proc. Hawaiian Ent. Soc. **10**: 133, 1938.

*Macranillus* Sharp, Fauna Hawaiiensis **3**: 286, 1903, *new synonym.*

Type of subgenus: *Nesomicrops kauaiensis* Sharp.

The differences between *Nesomicrops* and *Macranillus* cannot possibly be considered of sufficient importance to justify their inclusion in different subgenera, still less in different genera. The synonymy was suggested by Jeannel.

It is evident that the two species of *Nesomicrops* are allied to *Bembidion corticarium* (Sharp).

**Bembidion (Nesomicrops) kauaiensis** (Sharp), *new combination* (figs. 1*c*, 5).

*Nesomicrops kauaiensis* Sharp, Fauna Hawaiiensis **3**: 286, 1903.

*Length:* 2.8-3.1 mm. *Colour:* reddish brown; mouthparts, antennae and legs testaceous. *Head:* with eyes greatly reduced and almost flat; frontal grooves short and weakly impressed. *Pronotum:* with sides slightly sinuate in front of posterior angles which are slightly obtuse, but sharply pointed; base rather rough; two setiferous punctures on each lateral margin. *Elytra:* oval, widest in middle, tapering apically; striae feebly impressed and punctured, more strongly so towards suture; intervals slightly convex, third with three setiferous punctures, apical one of which is very indistinct. Surface of head, pronotum, and especially elytra with distinct isodiametric microsculpture.

Kauai: high plateau, August 1890 (*Perkins*), two females. "Found under deeply embedded rocks" (*Zimmerman*).

**Bembidion (Nesomicrops) coecus** (Sharp), *new combination* (figs. 1*d*, 4).

*Macranillus coecus* Sharp, Fauna Hawaiiensis **3**: 287, 1903.

*Length:* 2.5 mm. *Colour:* entirely reddish brown. *Head:* with eyes vestigial, pale in color and slightly convex, frontal grooves short and weakly impressed. *Pronotum:* rather broader than in *B. kauaiensis*, each side bearing two setiferous punctures; slightly sinuate in front of posterior angles which are square. *Elytra:* broader than in *B. kauaiensis*, tapering less towards apex; striae feebly impressed especially towards margins of elytra, not attaining either base or apex; punctured somewhat irregularly; intervals slightly convex, third with two setiferous punctures. Surface of head and especially of elytra with a coarse isodiametric microsculpture.

Kauai: high plateau, August 1896, (*Perkins*).

## Aedes Aegypti on Wake Island

By L. ROSEN, W. C. REEVES,[1] and T. AARONS[2]

*(Presented by E. C. Zimmerman)*

Wake is a coral atoll with a total land area of about four square miles, made up of three islets, Wake, Peale and Wilkes. The group is over 500 miles from the nearest habitable island, being 637 miles north of Kwajalein, 1,185 miles southeast of Midway, 2,130 miles due west of Honolulu, and 1,500 miles east of Guam. The island was in United States possession until December 1941 when it was captured by Japan. It was repossessed by the United States in September 1945.

All available records indicate that prior to December 24, 1941, there were no mosquitoes on Wake. A zoological expedition from the Bishop Museum visited the island in 1923 and made rather complete studies, but no mosquitoes were reported (1)[3]. Bohart and Ingram (2) in their exhaustive summary of the mosquitoes of the islands in the central Pacific make no mention of records from Wake.

In October 1947 the Alameda County Mosquito Abatement District received a collection of mosquitoes from Wake Island. The specimens were sent to Harold F. Gray, Engineer, Alameda County Mosquito Abatement District by Rodney R. Beard, M.D., Medical Director, Pacific-Alaska Division, Pan American Airways System. T. Aarons made a tentative identification of *Aedes aegypti* which was confirmed by Dr. Richard M. Bohart, University of California at Davis.

At the suggestion of W. C. Reeves, in January 1948 the senior author while visiting this island made more extensive collections of adult mosquitoes and larvae. All were identified by Reeves as typical *Aedes aegypti* (Linn.). Collections of both adults and larvae were made on Peale, but adults only were found on Wake. The adult mosquitoes were collected from human beings.

While the average annual rainfall is 33 inches, until recently there has been no fresh water available on the island. This is due to the low elevation, porosity of coral and sand, and limited vegetation, the shrub *Scaevola frutescens* predominating. In 1935 Pan American World Airways established an air base on Wake, and fresh water was first stored on the island. The run-off from roofs of buildings was collected and stored in covered cisterns with

[1] George Williams Hooper Foundation, University of California, San Francisco.
[2] Alameda County Mosquito Abatement District, Oakland.
[3] Figures in parentheses refer to literature cited at the end of this article.

screened vents. During their occupation, the Japanese built a number of small concrete catchment basins and other works in which rain water collects.

Larval collections during the present studies were all from abandoned Japanese concrete cisterns, water storage drums, and various discarded metal containers in which rain water had collected. In the immediate vicinity of the living quarters of personnel, water barrels and storage tanks have either been screened or covered with heavy oil.

Inquiries as to the biting activities of these mosquitoes disclosed that they were bothersome in certain brushy areas in the daytime and were seen only occasionally in the camp area on windless nights.

It is impossible at this time to determine how, when and by whom this mosquito was first imported to this isolated island. However, it is an outstanding record of the dependence of *Aedes aegypti* on man's means of transportation for its spread and the tendency of man to create suitable larval habitats.

The only available source of blood for these mosquitoes are the residents of Wake, large numbers of sea birds, rats, and a few cats and dogs. From available records it would appear that they feed on wild animals in most instances.

While no mosquito-borne disease has been reported, the importation of a case of dengue fever could potentially result in further cases. In view of the importance of Wake as an international air stop it will probably be desirable to eradicate this mosquito from the island. Because of the limited size of the island and the type of breeding place involved, such eradication should be easy if carried out by the standard methods of *Aedes aegypti* control.

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1. Bryan, E. H., Jr. Insects of Hawaii, Johnston Island and Wake Island. B. P. Bishop Museum, Bull. **31**, 1926.

2. Bohart, R. M. and Ingram, R. L. Mosquitoes of Okinawa and Islands in the Central Pacific. Navmed **1055**: 1-110, 1946.

# The Occurrence of Oxyethira maya in Hawaii (Hydroptilidae: Trichoptera)

By HERBERT H. ROSS

Illinois Natural History Survey, Urbana, Illinois

*(Presented by E. C. Zimmerman at the meeting of December 8, 1947)*

In 1943, E. C. Zimmerman reported the extremely interesting discovery on Oahu of some minute caddisflies belonging to the family Hydroptilidae, the first record of the order in the Hawaiian Islands. Recently Mr. Zimmerman very kindly sent me a series of these specimens for examination and, oddly enough, they prove to be *Oxyethira maya* Denning, described recently from Georgia, U. S. A. In the original description (Denning 1947) only a single specimen is recorded, indicating the possibility that the main range of the species lies elsewhere than the type locality, in all likelihood to the south of it. The specimens sent to me by Mr. Zimmerman consist of a short series collected by him at Moanalua, Oahu, October 10, 1940.

The adults of this genus are straw color and about 3 mm. long. The aquatic larvae construct a flat, silken pursecase which is not easy to detect, and is frequently attached to plants. It is probable, as Mr. Zimmerman has surmised, that some of the larvae were introduced into the Islands on living freshwater plant material. As pointed out above, the range of the species is so poorly known that it is difficult to guess from what point such an importation might have come.

Details of the diagnostic characteristics of this species may be obtained from the original description, and information regarding the biology and larval characteristics of the genus from Betten (1934) and Ross (1944).

## LITERATURE CITED

Betten, Cornelius, 1934. The caddis flies or Trichoptera of New York state. N. Y. State Mus. Bul. **292**. 576 pp., illus.

Denning, Donald G. 1947. Hydroptilidae (Trichoptera) from southern United States. Can. Ent. **79**: 12-20, illus.

Ross, Herbert H. 1944. The caddis flies or Trichoptera of Illinois. Ill. Nat. Hist. Survey Bul. **23**(1): 1-326, illus.

Zimmerman, Elwood C. 1943. On the establishment of the Order Trichoptera in Hawaii. Haw. Ent. Soc. Proc. **11**: 350-352.

# New Species of Hawaiian Lepidoptera

By O. H. SWEZEY

Consulting Entomologist, H.S.P.A.

(*Presented at the meeting of December 8, 1947*)

The holotypes of the species described herein are placed in the type collection of the Hawaiian Entomological Society.

## HYDRIOMENIDAE

**Eucymatoge stypheliae** n. sp.

Female. 19mm. Whole insect white, profusely sprinkled with black scales, giving it a nearly uniform gray appearance, with some black markings on the wings produced by the segregation of the black scales. Without the blackish striae which are so conspicuous in the numerous variations of *monticolans*, to which this species is otherwise related. Costa of forewings with a series of black markings, best developed on the basal third; the inner margin similarly marked; a somewhat distinct first line at one-fourth formed by the black scales, a little outcurved beneath costa then oblique to the inner margin; a somewhat double postmedial line at about three-fourths of costa formed by black scales and nearly parallel to the termen; terminal margin with an interrupted black line. Cilia grayish white, infuscated on basal half and some blackish scales at the terminations of the veins. Hindwings with crenate termen; similar in color to the forewings, with faint indication of wavy postmedial line of black scales, and interrupted black line on the terminal margin and a few black striae on inner margin; cilia grayish white with some black scales at termination of veins.

A single female reared from a caterpillar on *Styphelia tameiameiae*, on Kilauea Iki trail, May 26, 1947. The moth issued June 13. Other caterpillars were collected but failed to rear. There might have been *monticolans* among them, as it is known to feed on *Styphelia;* and there seemed to be two kinds of caterpillars. One kind differed from the others by having two pointed extensions from the anal prolegs. This might have been the caterpillar of the new species. The pupa seems to be similar to that of *monticolans*.

## SELIDOSEMIDAE

**Scotorythra apicalis** n. sp.

Male and female. 35-37 mm. Head and thorax brownish fuscous, whitish sprinkled. Abdomen whitish. Fore and middle legs fuscous, tarsus white-ringed; hind legs ochreous, with slight fuscous markings. Forewings brownish fuscous, with numerous indefinite whitish markings: a few strigulae irregularly placed on costa, first line at about one-sixth, outwardly angled at about middle, a rhomboidal patch at apex enclosing a small roundish fuscous costal spot; a series of oval darker fuscous spots from about five-sixths of costa and running parallel to termen bordered anteriorly and posteriorly by indistinct crenate whitish lines; area basad from first line darker fuscous,

whitish at extreme base; an undefined discal darker fuscous spot; beneath pale brownish, with some of the fuscous markings showing through. Forewings in male sufused with darker fuscous so that the whitish markings are obscured. Hindwings in both sexes pale grayish, with an obscure darker discal spot and indication of a sinuate postmedian line, less evident in the female, termen with a series of faint infuscations.

Holotype female, Kilauea, Hawaii, April 17, 1944 (N. L. H. Krauss); one allotype male and four paratype males, in light trap, Hawaii National Park, Kilauea, Hawaii, Oct. 16, Nov. 26, Dec. 10, 1946, June 16, 1947 (C. J. Davis). More material is needed for more complete description.

## PYRAUSTIDAE

**Omiodes pritchardii** n. sp.

Male and female. 30mm. Head thorax and abdomen brownish ochreous, with a slight ferruginous tinge; palpi brown, lower half whitish; abdominal segments with white apical margins; anal tuft in male pale brownish. Legs pale brownish. Forewings pale brownish ochreous, with a slight ferruginous tinge and sprinkled with fuscous scales, the male more strongly suffused with ferruginous; first line whitish edged posteriorly with fuscous scales, obtusely angled outwards in middle, from one-fourth of costa to one-third of inner margin; a fuscous transverse discal spot; second line whitish, from three-fourths of costa to three-fifths of inner margin, sinuate outwards beneath costa, below middle forming an angular projection outwards, anteriorly margined with dark fuscous; a terminal series of black triangular spots between the veins; cilia pale brownish, darker at base. Hindwings pale brownish, with a sprinkling of fuscous scales; an indistinct darker discal spot; a wide whitish line from two-thirds of costa to anal angle, with an outward angular projection about in middle, anteriorly margined with dark fuscous; a dark fuscous termnal line; cilia as in forewings.

Reared from caterpillars feeding on leaves of *Pritchardia beccariana* palms growing in the forest along the Kulani road, 9 or 10 miles northwesterly from Mountain View, Hawaii, May 27, 1946 and May 29, 1947, by O. H. Swezey and C. J. Davis. The caterpillars were differently marked than any known species of *Omiodes*. They varied somewhat in the head markings and also on the cervical plate, but an accurate description was not made. They come the nearest to the markings on *blackburni* caterpillars which also vary some, but not so much as this species. One caterpillar had the head and cervical plate mostly dark, nearly black, and all dorsal setae of the body segments situated in dark-outlined plates. This caterpillar produced the one male which was reared.

*Omiodes pritchardii* has the general wing pattern of the group consisting of *blackburni* on coconut palm (also on banana), *meyricki, maia, musicola* and *fullawayi* on wild banana, but is nearest to *blackburni*, from which it differs in having a more grayish or drab coloration, and the first line of forewing being obtuse angled instead of acute. More material is needed for more complete description.

# A new Genus and Species of Aradidae from Fiji (Hemiptera)

By ROBERT L. USINGER
University of California, Berkeley

*(Presented by E. C. Zimmerman at the meeting of December 8, 1947)*

The material upon which the present paper is based is part of a magnificent collection of Hemiptera made by E. C. Zimmerman in the Fiji Islands in 1938 during Bishop Museum's Henry G. Lapham Fijian Expedition. The aradids are especially well represented. Reports on the various groups of aradids will appear from time to time, in connection with revisions of the Aradidae of Oceania. Meanwhile, a remarkable new genus is described below so that the name can be used in phylogenetic studies.

## **Zimmermania** Usinger, new genus

Elongate, strongly attenuated anteriorly. Body surface covered with a white incrustation. Head relatively small, the clypeus obsolescent, so reduced that there is no anterior process between the antennae, the anterior-most part of the head being the antero-ventral point of origin of the rostrum. Antennae long, the first segment as long as head, second two-thirds as long as first, third longest, one-sixth longer than first, fourth shortest. Rostrum shorter than head, its base exposed to anterior view, the ventral surface of the head deeply sulcate.

Pronotum trapezoidal, narrowed anteriorly, the lateral margins, especially anteriorly, thickly but openly incrustate. Scutellum short, strongly transverse, its margins sinuate. Hemelytra reduced to small, oval pads at basal angles of scutellum. Abdomen depressed, moderately dilated, the anterior connexival angles but little prominent, those of fifth visible segment roundly prominent, the connexival margins of sixth visible segment deeply scalloped and then angulately produced. Spiracles of first and second visible segments lateral, the remaining spiracles sublateral with the exception of those of the eighth segment which are, of course, terminal.

Under surface moderately convex. Prosternum distinctly sulcate. Ostiolar orifices obscure, reduced to short, incrustate grooves behind middle coxae, not reaching lateral margins of body.

Legs very long and slender. Front tibiae with a slender, acute spine subapically. Tarsi with bristle-like arolia.

### Genotype: *Zimmermania brachyptera,* new species

This is one of the most unusual of all aradids in general appearance. I do not know of any close relatives. However, it belongs to the group of genera with incrustate bodies and reduced ostiolar canals, including *Carventus* and *Proxius*. It differs from these and from all other aradids in the greatly reduced anterior process of the head and in the presence of subapical spines on the front tibiae. I take great pleasure in dedicating this genus to my friend and

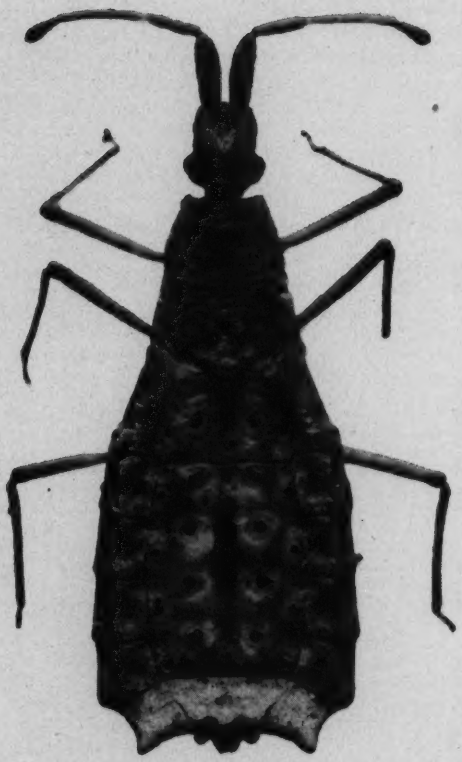

Figure 1. *Zimmermania brachyptera* Usinger, new genus and species, female holotype, dorsal view.

colleague, E. C. Zimmerman, who has done so much to advance our knowledge of the Hemiptera and other groups of Pacific Island insects.

**Zimmermania brachyptera** Usinger, new species (Figure 1).

Female. Head a little longer from posterior constriction to apex than wide across eyes, 35::31; subparallel in front of eyes and then rounded to brief, plate-like antenniferous tubercles which do not reach apex of head. Clypeus extremely short, deflected downward, reaching only to base of antennae, with a minute, finger-like jugum on each side. Antero-ventral portion of head produced beyond clypeus to basal third of first antennal segment, the rostrum arising from its tip. Disk of head convexly incrustate, deeply impressed on either side of middle, with two longitudinal, crescent-shaped pits. Eyes small, one-fourth as wide as interocular space, 5::21. Posterior portion of head strongly constricted, without trace of postocular tubercles, the neck short, less than half as wide as head across eyes, 14::35. Rostrum two-thirds as long as head, inserted at apex of an oblique, antero-ventrally directed process. Antennae about as long as head, pronotum and scutellum; proportion of segments 1 to 4 as 32:20:33:14; first segment stout, twice as wide at middle as an eye, slightly tapering at each end, beset with short, setigerous granules; second and third segments half as thick as first, subcylindrical, beset with short, stiff setae; last segment slender at base, enlarged towards apex and subrounded and densely pubescent at tip.

Figure 2. *Zimmermania brachyptera* Usinger, new genus and species, male allotype, (a) right paramere, (b) posterior surface of genital capsule.

Pronotum almost half again as long on median line as head, 47::35; one-seventh wider behind than long, 54::47; disk depressed at middle, the incrustation interrupted anteriorly by eight glabrous spots; surface with rows of fine granules, especially posteriorly. Lateral margins anteriorly and front margin with a pie-crust type of incrustation extending outward from actual pronotal margin, interrupted in side view, where the ventral incrustation meets the dorsal one.

Scutellum over twice as broad as long, 42::19; disk depressed, granular except at middle, the anterior margin notched at middle, the sides sinuate and apex rounded.

Hemelytral pads short, subtriangular as seen from above, approximately one-third as long as scutellum, 7::19.

Abdominal disk depressed, flattened, relatively smooth, the granules very sparse and small; a transverse suture just behind level of first visible abdominal segment and another at posterior margin of fifth abdominal segment. Two dorsal abdominal scent gland openings at levels corresponding to hind margins of second and third abdominal segments. Glabrous areas forming

a pattern in the otherwise uniformly incrustate surface. Connexivum elevated above, more coarsely granular.

Female genital segments produced posteriorly into a short, subtriangular process which is notched at apex and which exceeds the lobes of seventh visible segment. Ventral plates granular, convex, the inner apical angles of basal plates briefly, angulately produced.

Male genital segments strongly convex, the disk of sixth tergite strongly elevated. Strap-like projections of seventh visible segment short, half as long as genital capsule seen from above. Capsule deeply embedded in abdomen, its posterior surface (Figure 2, b) convex along middle, depressed laterally, granular laterally and dorsally, rugose at middle. Parameres (Figure 2, a) obliquely lobed apically.

Size: Male, length 5.45 mm., width (across fourth abdominal segment) 2.15 mm. Female, length 6.15 mm., width 2.55 mm.

Holotype, female, Tholo-i-suva, Viti Levu, Fiji, July 25, 1938, 500 feet elev., beating, E. C. Zimmerman collector. Allotype, male, same locality, July 21, 1938, elevation 500 to 600 feet, E. C. Zimmerman collector. The holotype is in B. P. Bishop Museum, Honolulu, T. H. The allotype is in the collection of the author.

# New Species and New Records of Elaterid Beetles from the Pacific—III[1]

By R. H. VAN ZWALUWENBURG

(*Presented at the meeting of November 10, 1947*)

Since the war various collections of elaterid beetles from the Pacific area have been submitted for study. Among them are the collections made by R. G. Oakley and H. K. Townes, during an economic entomological survey of Micronesia in 1946. Other collections were made by H. P. Chandler, Jean Laffoon, Borys Malkin and L. A. Conwell, incidental to their military service in the Pacific area. In addition, the U.S. National Museum has made available for study miscellaneous Pacific island material in its possession. Other material is present in the Hawaiian Sugar Planters' Association collection, including specimens taken by D. B. Langford, J. P. Martin and the late Dr. Frederick Muir.

Among this material have been found numerous new island records, as well as seven new species here described for the first time. Types of the latter are deposited in the various institutions to which they belong, as stated in the text. New records of island groups are printed in capital letters, new records from individual islands, in italics. Illustrations for this paper were prepared by James T. Yamamoto of the Experiment Station, H.S.P.A., Honolulu.

**Compsolacon gracilis** (Candèze)

3 males (Micronesia No. 737) from Son Son, Rota, Marianas, collected on corn tassels by R. G. Oakley, June 26, 1946, are extremely close to *C. gracilis,* and I identify them as this species for the time being. These specimens have the pronotum somewhat more flattened than typical *gracilis,* but there seem to be no morphological differences, and the aedeagi are so similar to those of *gracilis* from New Guinea as to be indistinguishable. A male from Moen Island, Truk atoll, Caroline Islands, collected by D. B. Langford, is identical with the specimens from Rota.

**Compsolacon gracilis** (Candèze) **specularis** Van Zwaluwenburg

Twelve specimens, in addition to the series originally described (Proc. Hawaiian Ent. Soc., 12: 109, 1947), are from Hollandia, New Guinea, Borys Malkin, coll. So far only females of this variety are known, and Hollandia is the only locality in which it has been

[1] The first paper of this title was published as Bishop Museum Occ. Papers, vol. xvi, no. 5, pp. 91-130, 6 figs., Oct. 18, 1940; the second was published in Proc. Hawaiian Ent. Soc., vol. xi, no. 3, pp. 289-300, 3 figs., August 1943.

taken. The impunctate area on the penultimate sternite of *specularis* appears in typical *gracilis* to be a secondary sexual character confined to the female.

**Alaus niger** n. sp.

Length 19-21 mm.

Subparallel; black; pubescence squamiform, generally black with, on pronotum, an inconspicuous band of obscure brown along either side, two narrower bands along either side of disc, widening to a spot behind middle, and a narrow band of the same color on base of pronotum. There is also an area (lighter in color, and more evident in the paratype) of obscure brownish pubescence on outer half of base of each elytron, and at base of pronotum.

Front excavate on disc; anterior margin depressed; punctation uniform, fairly coarse. Antennae short, extending but little beyond middle of prothorax; segment 2 very small; 3-10 broadly serrate; 3 nearly as long and as wide as 4, but with outer angle more acute than in 4; 5-10 subequal, similar, shorter than 4, but as wide; 11 abruptly narrowed on apical one-fourth.

Prothorax longer than wide (middle dimensions); sides subparallel from base of hind angles to about anterior third, thence evenly rounded to anterior angles. Pronotum evenly convex transversely; punctation about as on front, but sparse on disc, more crowded laterally and subrugose on basal portion; a median longitudinal carina extending to anterior margin (more evident in paratype). Anterior margin without angulation at any point between anterior angles. Basal declivity abrupt, with blunt longitudinal, median ridge. Hind angles stout, posteriorly divergent; bluntly unicarinate, the carina short, paralleling outer margin of angle on its anterior half or more.

Scutellum in a single plane, very precipitous; anterior margin widely emarginate, the posterior, truncate; slightly longer than wide, widest at posterior third; convex on middle, impressed on either side behind.

Elytra at base as wide as hind prothoracic angles; sides subparallel to beyond middle, thence conjointly narrowed posteriorly; apex of each emarginate, the outer angle more acute than the sutural; tranversely convex at base, basal declivity very abrupt and regular. Striae with feebly impressed punctures on disc; punctures stronger toward sides. Intervals flat, somewhat convex toward base, but without suggestion of raised crest or tubercle.

Mucro horizontal, excavate between fore coxae; sides of mesosternal cavity parallel, subhorizontal. Punctation on underside of prosternum about as on pronotum; finer and denser on rest of undersurface.

Described from a holotype female, AMBOINA, November 1907, Muir coll.; and a paratype female, Amboina, no date, Muir coll. Both are in the type collection of the Hawaiian Sugar Planters' Association Experiment Station, Honolulu.

This species superficially resembles *Alaus regalis* Candèze, and in fact for some years escaped notice among a long series of varieties *a* and *b* of *regalis* from Ceram. However, well-marked morphological differences separate the two, as follows:

| **A. niger,** female | **A. regalis,** female |
|---|---|
| 1. Segment 3 of antenna subequal to 4 | Segment 3 more nearly size of segment 2. |
| 2. Frontal margin of pronotum evenly rounded. | Frontal margin of pronotum subangulate either side of middle. |

| | |
|---|---|
| 3. Carina of hind prothoracic angle anteriorly parallel to outer margin of angle. | Carina of hind prothoracic angle divergent from lateral margin. |
| 4. Base of pronotum prominent medianly, but not tuberculate. | Base of pronotum definitely tuberculate on middle. |
| 5. Scutellum not much longer than wide; very strongly inclined at an angle of about 70 degrees. | Scutellum definitely elongate; angle of inclination about 45 degrees. |
| 6. Elytra without tubercle. | Elytra definitely tuberculate near base. |

**Tetrigus townesi** n. sp.

Length 18.0 mm.; width about 4.5 mm. Slender; dark rufous; pubescence coarse, tawny, recumbent, uniform on both upper and under sides.

Front shallowly, widely concave; anterior margin truncate; punctation close, uniform, moderately coarse. Antenna of male short, not attaining basal declivity of pronotum; segments 2 and 3 equal, shorter than wide; segment 4 slightly shorter than 5; 5-10 progressively longer; 11 nearly half as long again as 10, widest at posterior third, narrowed apically; segments 4-10 each with slender lamella arising from base, those on 5-9 subequal in length, that on 4 slightly shorter, and on 10 shorter still. Antenna of female somewhat shorter than in male, with shorter lamellae and with segments 4-11 relatively shorter and more robust.

Prothorax longer than wide in both sexes; sides (male) straight, narrowing slightly from tips of hind angles to anterior fourth, or (female) widening slightly from base of hind angles to anterior third, at which point the prothorax is widest. Pronotum with punctation simple, uniform, moderately coarse, slightly more crowded toward anterior angles. Pronotum strongly convex transversely, basal declivity abrupt, a low median elevation on the declivity. Hind angles robust; in the male faintly divergent, continuing the outline of the sides, in the female diverging slightly backward; strongly, briefly unicarinate, the carina almost exactly bisecting the angle. A deep groove just mediad of the lateral carina on pronotum extends from hind angle to anterior margin. Prosternal lobe bluntly angled medianly. Propleura widely concave on anterior half. Mucro slightly upcurved behind fore coxae. Sides of mesosternal cavity sub-horizontal, anteriorly divergent at base, then slightly convergent.

Scutellum strongly declivous; elongate; gently convex (transversely); pubescence somewhat longer and thicker than elsewhere on dorsum.

Elytra transversely convex; narrower at base than hind prothoracic angles, then widening and thence backward subparallel to middle (male) or beyond (female); apex strongly mucronate, the sutural line curving strongly outward near apex. Basal declivity rather abrupt. Striae faintly impressed, subobsolete; the punctures hardly more apparent than those on the interstriae; intervals nearly flat. Hind coxal plates wider at insertion of coxae than at outer margin; hind margin rounded at widest point. Tarsi simple. Apex of last abdominal sternite definitely truncate in female, more vaguely so in male.

Described from a holotype male, Agaña Airport, *Guam*, MARIANAS, June 13, 1936, H. K. Townes coll. (Micronesia No. 658),

on screen of building; and an allotype female, same data. The holotype has been deposited in the U.S. National Museum (No. 58525), and the allotype in the B. P. Bishop Museum.

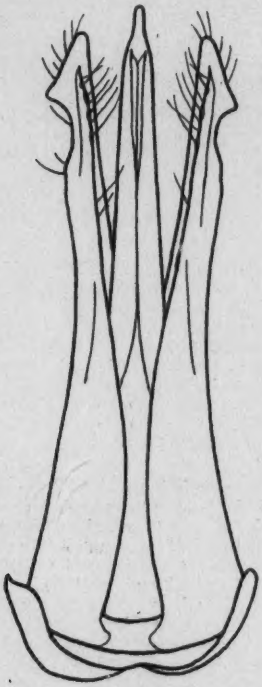

Figure 1. *Tetrigus townesi* n. sp., aedeagus, holotype male.

The aedeagus (Figure 1) has the tip of each lateral lobe triangularly expanded. The antennae of the male are definitely shorter than those of the same sex in *T. flabellatus* (Germar). *T. townesi* differs from the description of the Philippine *T. bakeri* Fleutiaux in having the hind coxal plate definitely and rather strongly widened on its inner third, and in having the frontal margin of the head definitely truncate rather than rounded.

**Dioxypterus vitticollis** Heller

1 specimen, Munda, *New Georgia,* Solomon Islands, March 1945, L. A. Conwell, coll.; a new island record.

**Symphostethus humeralis** n. sp.

Length 13.0 mm. Color generally dull black, with following exceptions: (1) prothorax orange-red; on pronotum a round black mark on middle of about anterior third, and a smaller, more or less oval lateral black spot on about anterior third, which just fails to touch lateral carina; tips and carinae of hind angles blackish; (2) elytra each with roughly triangular orange-red mark at base, extending from crest of elevated third interstrial interval, to ninth interval, and anteriorly onto flexed portion of the humerus; this mark extends farthest back on seventh interval, extending back for almost one third the length of the elytron; (3) coxae, femora and (roughly) basal half of tibiae, orange-red; (4) meso- and metasternum reddish yellow medianly. Pubescence fine, recumbent; black on black areas, orange-red on reddish areas, with the exception that, on anterior middle of front of head, there is a patch of orange-red pubescence.

Front flat behind disc, convex anteriorly; margin rounded, vaguely defined along middle; punctation fine, uniform, close-set. Antennae almost attaining tips of hind prothoracic angles; strongly serrate from segment 3 on; segment 2 small, wider than long; 3 as long as 4 but narrower; 4-10 diminishing slightly in length; 11 a little longer than 10, bluntly rounded at apex.

Prothorax about as long as wide; sides subparallel from base of hind angles to about middle, thence arcuate to anterior margin. Pronotum moderately convex; basal declivity gentle, with fine median carina which widens posteriorly to form a blunt ridge; posterior angles long, divergent from outline of sides, bicarinate, the inner carina the stronger. Punctation very fine, uniform, close-set, coarser on anterior half of sides. Mucro slightly upcurved behind fore coxae. Mesosternal cavity with sides prominent, horizontal basally, perpendicular in front.

Scutellum longer than wide; convex; finely punctulate.

Striae consisting of fine, close-set, moderately impressed punctures. Interval 3 elevated at base; otherwise all intervals more or less flat. Apex of each elytron emarginate with an outer mucro more prominent than the sutural angle. Apex of last abdominal sternite bevelled at tip, roundly emarginate.

U.S. National Museum No. 58526.

Described from a holotype believed to be a female, *Bougainville*, SOLOMON ISLANDS, 1944, N[avy] M[edical] R[esearch] U[nit] No. 2, lot. 9. Its color pattern sufficiently distinguishes it from all other described members of the genus.

**Propsephus compactus** Van Zwaluwenburg

1 male and 1 female, Munda, *New Georgia*, Solomon Islands, 1944, L. A. Conwell; a new island record.

**Propsephus nigripilis** Van Zwaluwenburg

1 female, Munda, *New Georgia*, Solomon Islands, 1944, L. A. Conwell; a new island record.

**Simodactylus hesperius** Van Zwaluwenburg

1 specimen, *Moen Is.*, Truk atoll, Carolines, May 23, 1946, at light, U.S. Navy coll.; a new island record. 2 specimens, *Ponape*, Carolines, August 1946, J. E. Alicata coll.; a new island record.

**Simodactylus lineatus** n. sp.

Length males, 11.0-14.5 mm.; female, 12.5 mm.

Shiny; yellowish brown, with elytra slightly darker brown, and anterior

margin of head, scutellum, inflexed portion of elytra and a narrow median, longitudinal band on pronotum, dark brown to black; propleura and legs flavous. Pubescence light brown, fine, uniform and fairly dense.

Front convex on disc; anterior margin broadly rounded, slightly reflexed. Punctation finely umbilicate (reduced in size on posterior margin). Antennae feebly serrate, not attaining apex of hind prothoracic angles; segments 3-10 longitudinally subcarinate on outer face; segment 2 small; 3 slightly narrower at apex than 4-10, in length 3 is subequal to 5, and shorter than 4, which is the longest; segment 11 elongate oval, slightly longer than 10.

Prothorax (middle dimensions) slightly longer than wide (male) or about as long as wide (female); sides subparallel or slightly convergent from base of hind angles to a little behind middle, thence arcuately narrowed to anterior margin. Pronotum moderately convex, gently declivous at base which is widely channeled medianly. Hind angles slightly divergent, flaring somewhat from outline of sides; bicarinate, the inner carina the stronger. Punctation of pronotum fine, simple, close-set on disc, becoming subumbilicate laterally, particularly on anterior half. Mucro gently upcurved behind fore coxae. Mesosternal cavity declivous, sides strongly divergent anteriorly.

Scutellum longer than wide; pointed behind; finely punctulate.

Elytra at base as wide as prothorax across hind angles; sides subparallel to about middle (male), or beyond (female). Apex of each elytron briefly emarginate, the outer angle broadly rounded, the sutural angle submucronate. Striae with moderately fine, evenly spaced punctures; intervals flat, finely punctulate. Hind coxal plates broadly rounded at widest point, not acuminate. Lobes of tarsi broad, especially on 4th segment.

U.S. National Museum No. 58527.

Described from a holotype male, *Nukuoro Island,* Nukuoro atoll, CAROLINES, August 6, 1946, H. K. Townes (Micronesia No. 1613), damaging *Crinum* flowers; an allotype female, same data; and 12 paratype males, same data.

This species differs from *S. pallidus* Fleutiaux, sex for sex, in having the prothorax more arcuate in outline from the middle forward; in addition the pronotum is less strongly convex in *lineatus*. The male aedeagus (see Figure 2) differs from that of *S. pallidus*.

**Simodactylus marianorum** n. sp.

Length males, 12.5-14.5 mm.; females, 14.0-16.5 mm.

Elongate; subnitid; yellowish brown, with head, a variable discal area on pronotum, fore and hind margins of prothorax, prosternum, scutellum and median portions of abdominal sternites, darker brown; or, generally dark brown, with sides of prothorax, above and below, a little lighter. Pubescence fine, short, yellowish brown.

Front flattened anteriorly, otherwise gently convex; anterior margin broadly rounded, not reflexed except at very ends. Punctation simple, fine, close and fairly uniform. Antennae feebly serrate; failing to attain tips of hind prothoracic angles by about 2 or 3 segments; segments 3-11 longitudinally subcarinate on outer face; segment 2 small; 3 as long as 4, but narrower; 4-10 slightly decreasing in length; 11 as long as 10, narrowed on apical third.

Prothorax (middle dimensions) as long as wide (both sexes); sides faintly arcuate from base of hind angles, more strongly narrowed anteriorly. Pronotum moderately convex, flattened on disc, basal declivity abrupt with a brief median channel. Pronotal punctation simple, a little coarser than on front, especially toward sides, where it is more close-set. Hind angles elon-

gate, acute, diverging from outline of sides of prothorax; bicarinate, the carinae of about equal strength, the outer the longer.

Scutellum declivous; longer than wide; convex at about posterior third; finely punctate.

Elytra convex; at base about as wide as prothorax; sides subparallel to about middle (male), or beyond (female), thence more strongly narrowed to apex, which is bluntly rounded with the sutural angle finely mucronate. Striae lightly impressed, their punctures fairly fine, close-set; intervals flat except toward base. Mucro gently upcurved behind fore coxae; mesosternal cavity declivous, its sides anteriorly divergent. Hind coxal plate with a rather prominent rounded tooth at about its inner third. Lobes of tarsi broad, particularly on 4th segment.

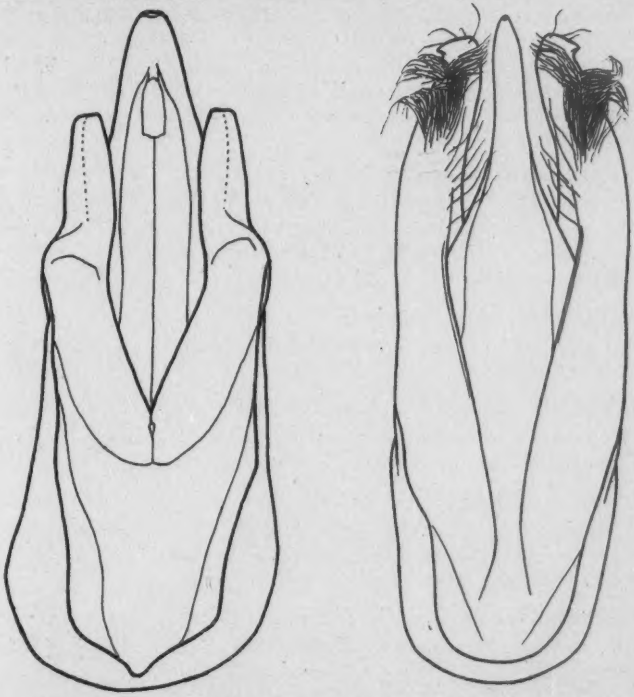

Figure 2. *Simodactylus lineatus* n. sp., aedeagus, paratype male.
Figure 3. *Simodactylus marianorum* n. sp., aedeagus, paratype male.

U.S. National Museum No. 58528.

Described from a holotype female, Son Son, *Rota Island,* MARIANAS, June 26, 1946, R. G. Oakley (Micronesia No. 797), on corn tassels; an allotype male, Mt. Lasso, *Tinian Island,* Marianas, June 16, 1946, F. C. Hadden; 7 paratype males, Son Son, Rota,

June 26, 1946, R. G. Oakley (Micronesia No. 797), on corn tassels; 1 paratype male, Agaña Airport, *Guam,* Marianas, June 13, 1946, H. K. Townes (Micronesia No. 658), "screens-building"; 5 paratype males, Mt. Lasso, Tinian, June 16, 1946, F. C. Hadden; 1 paratype female, Son Son, Rota, June 26, 1946, R. G. Oakley (Micronesia No. 797), on corn tassels; and 2 paratype females, Mt. Lasso, Tinian, June 16, 1946, F. C. Hadden.

This species has the habitus of some of the Philippine species of *Simodactylus,* but does not have the tips of the elytra dehiscent and drawn into an acute spine. The Tinian specimens are generally darker than those from Rota and Guam, with the result that the latter have the light and dark colors more strongly contrasted. Possibly the fragment collected on Mt. Alifan, Guam in 1936 by Dr. R. L. Usinger, and identified (Insects of Guam—I: 53, 1942) as *Simodactylus* sp., is this species. The male aedeagus of *marianorum* is shown in Figure 3.

**Simodactylus pallidus** Fleutiaux

1 specimen, Airai, *Babelthuap,* Palau, Carolines, April 20, 1936; Z. Ono coll. 1 specimen, *Koror,* Palau, July 20, 1946, at light, R. G. Oakley (Micronesia No. 1165). Both records are new for the Palau archipelago.

**Simodactylus risbeci** Fleutiaux

1 male, *Espiritu Santo,* New Hebrides, J. L. Laffoon, 1944; a new island record.

**Simodactylus spinifer** Van Zwaluwenburg

2 specimens, Munda, *New Georgia,* Solomon Islands, 1944 and February 1945, L. A. Conwell; a new island record.

**Conoderus pallipes** (Eschscholtz)

1 specimen, J. P. Martin, June 11, 1947, *Wake Island,* at light. 1 female, *Eniwetok,* Marshall Islands, May 18, 1946, Oakley & Townes. Both of these island records are new.

**Aeoloderma brachmana** (Candèze)

46 specimens, Zamboanga, *Mindanao,* Philippine Islands, at light, October 1945, J. L. Laffoon; a new island record.

**Megapenthes brunniventris** Candèze

This species varies considerably in the extent and intensity of the blackish maculations. Two females and one male from Amsterdam Is., New Guinea, collected by G. H. Penn, September 27, 1944, are more brightly colored than Port Moresby specimens, and have the blackish pattern on the elytra more clearly defined. One specimen has the maculation on the pronotum reduced to a fine median stripe which connects anteriorly with a suffused blackish area.

**Melanoxanthus bellulus** n. sp. (Figure 4)

Length 4.1-4.8 mm.

Blackish; pubescence very fine, inconspicuous, yellowish, recumbent, with sometimes a few, fine, semi-erect, whitish hairs visible on the elytra . Frontal margin rufous on either side; antennae rufous. Pronotum with anterior margin yellowish on outer one-fourth, hind angles yellow (lateral and hind margins and carinae, blackish); each elytron with yellow humeral area which extends across base to scutellum, and backward on sides for about one-fourth length of elytron; on posterior one-half or one-third of elytron an elongate yellow vitta which may or may not attain in part, the lateral margin; in one specimen the anterior and posterior yellowish areas are vaguely connected by a line of the same color along the 6th and 7th interstriae. Scutellum black. Underside blackish, with median areas rufous to yellowish; hind angles of prosternum yellowish; legs rufous to yellowish.

Front convex, anterior margin broadly rounded, punctation close, finely, shallowly umbilicate. Antennae in both sexes not attaining tips of hind angles of prothorax; segment 3 one and one-half length of 2; 2 and 3 together subequal to 4; 4-10 subserrate, shortening successively; 11 longer than 10, rounded apically. Prothorax as long as greatest width (across tips of hind angles), sides subparallel at base along length of hind angles, thence narrowed

Figure 4. *Melanoxanthus bellulus* n. sp.

anteriorly to anterior margin. Punctation of pronotum shallow, aciculate anteriorly on middle, elsewhere finely umbilicate, more coarsely so on sides; pronotum strongly convex on sides, basal declivity rather abrupt, finely channeled on middle, a round, blackish impression on either side of the base about one-fourth of distance in from tips of hind angles; hind angles stout, acute, directed straight backward, strongly unicarinate.

Scutellum longer than wide, widest at anterior one-fourth; moderately precipitous; gently convex, finely punctulate.

Sides of elytra subparallel to about middle (female) or to anterior one-third (male) thence conjointly narrowed to apex; apex entire, finely mucronate at sutural angles. Striae consisting of close-set, punctations; intervals flat, subrugosely punctulate anteriorly.

Propleura sparsely umbilicate-punctate, with hind angles impunctate; punctation of prosternum finer and more close-set. Mucro more or less horizontal for entire length, sides between fore coxae elevated. Mesosternal cavity sloping, sides moderately elevated, anteriorly divergent. Hind coxal plates rather sharply acute laterad of insertion of coxae.

U.S. National Museum No. 58529.

Described from a holotype female, Amsterdam Is., New Guinea, September 27, 1944, G. H. Penn, coll.; an allotype male, Milne Bay, New Guinea, 1944, G. H. Penn, coll., and two probable female paratypes: one, same data as holotype, the other, October 8, 1944, Amsterdam Is., G. H. Penn, coll. The holotype, allotype and one paratype have been deposited in the U.S. National Museum, the other paratype in the Bishop Museum, Honolulu.

**Melanoxanthus glyphonides** Van Zwaluwenburg

A specimen from Hollandia, Dutch New Guinea, June 1945, B. Malkin coll., is probably this species. It exhibits some variation in the dorsal maculations as compared with the type from Koitaki, Papua. In the present example the yellowish markings on either side of the scutellum are absent, and the oval spot on the anterior third of the elytra is considerably longer than in the type.

**Anchastus rufangulus** Candèze

1 specimen, Osmeña, *Samar*, Philippine Islands, sea level, April 9, 1945, J. L. Laffoon; a new island record.

**Cardiophorus decoratus** n. sp.

Length 3.0-3.5 mm. Stout, oblong; prothorax nitid, black; antennal segments 1 and 2 rufous; each elytron with reddish yellow area of variable extent: in one individual (female) it lies across strial intervals 3-6 and extends backward a little more than one fourth the elytral length, its hind margin well-defined; in the other (male) this yellowish area lies across intervals 2-6 and extends backward to beyond the middle with its posterior limits vague and ill-defined; legs pale yellow, the trochanters sometimes dusky at base, the tarsi with rufous tinge. Pubescence very fine, semi-erect, fulvous.

Front convex; anterior margin slightly elevated, subangulate at middle; punctation fine, sparse, even. Antennae exceeding hind angles of prothorax; segments 2 and 3 equal in length, together longer than 4 (female) or subequal to 4 (male); segments 4-11 slightly diminishing in length.

Prothorax (middle dimensions) but slightly wider than long (male), or definitely wider than long (female), sides arcuate from tips of hind angles

(more strongly so in female). Pronotum strongly convex; punctation on disc about as on front, weaker toward base, more crowded toward anterior angles; hind angles short, flat, without carina; lateral carina on margin (not inferior) extending forward to middle or beyond, absent anteriorly; base moderately declivous; sulci elongate, double, widely, shallowly excavate after leaving basal margin, anteriorly divergent.

Scutellum subcordiform, the anterior margin not notched; flat; very finely, sparsely punctulate.

Elytra at base as wide as space between hind prothoracic angles; sides parallel to about middle or beyond, thence narrowed to conjointly rounded apex. Striae consisting of rather coarse linear impressions, which posteriorly become round punctures and are more widely separated; intervals convex, somewhat flattened toward base, very finely punctulate.

Punctation of undersurface somewhat coarser than on upper; generally finer, sparser on median areas. Claws simple with slight widening at base.

U.S. National Museum No. 58530.

Described from a holotype female, Hollandia, Dutch New Guinea, June 1945, B. Malkin; and an allotype male, same data.

The claws will distinguish this species from *Platynychus eucalypti* (Blackburn) in which they are described as widely, subangulately dentate; it also is smaller than *P. eucalypti.*

**Neodiploconus exilis** Van Zwaluwenburg

1 male, 1 female, *Koror,* Palau, July 18, 1946, R. G. Oakley (Micronesia No. 1181), at light; 1 male Mog Mog, *Ulithi,* July 11, 1946, H. K. Townes (Micronesia No. 1238), under bark of dead *Artocarpus "altilis."*

In the original description (Bishop Mus. Occ. Papers, **16**[5]: 127, 1940) it was stated that the elytra in this species are less strongly emarginate at the apex than in *N. erythropus* (Candèze); this character now appears to vary in that respect more than was at first realized. The male aedeagi of *exilis* and *erythropus* are very similar, exhibiting only slight differences.

**Neodiploconus nigrifrons** (Schwarz)

5 specimens, Munda, *New Georgia,* Solomon Islands, March 1945, L. A. Conwell; a new island record.

**Melanotus ebeninus** Candèze

1 specimen, Osmeña, *Samar,* Philippine Islands, sea level, April 9, 1945, J. L. Laffoon; a new island record.

**Melanotus guambatae** Van Zwaluwenburg

This Solomon Island species is separable from the New Guinea *M. albertisi* Candèze, by the longer, coarser pubescence of *guambatae,* and its wider punctures, particularly on the metasternum. Some *albertisi* have the elytra bright reddish brown, except for the black sutural and lateral margins. In all the *guambatae* so far examined the elytra are never other than dark brown.

Further examination shows a striking difference in the aedeagi of the two species. Each has, at more or less the middle of the outer margin of the lateral blade of the aedeagus, a large, well-defined barb or hook, a structure I have never before found in elaterid aedeagi. (See figures 5 and 6.) In *M. albertisi* the distance between the barb and the outer angle of the terminal lobe of the lateral

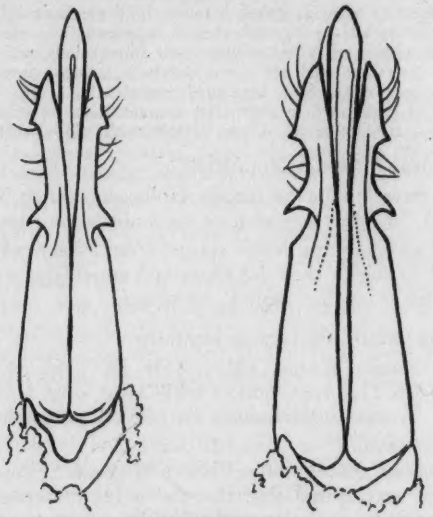

Figure 5. *Melanotus guambatae* Van Zwal., aedeagus.
Figure 6. *Melanotus albertisi* Candèze, aedeagus.

blade, is subequal to the length of the terminal lobe (as measured from base opposite outer angle to the apex). In *guambatae* the distance between the outer angle and the barb is nearly twice the length of the lobe. The ratios of length of terminal lobe to distance from angle to barb are: *albertisi,* 1:0.9; *guambatae,* 1:1.9. These ratios appear consistent for *albertisi* (from three widely separated localities on New Guinea) on the one hand, and for *guambatae* (from Guadalcanal) on the other.

**Hapatesus hirtellus** Candèze

Twelve specimens from Hollandia, Dutch New Guinea, collected by B. Malkin in May and June 1945, have the prothorax more brightly reddish than the elytra and have a longitudinal median blackish marking on the pronotum. Another specimen from the same locality, B. Malkin, July 1945, is more uniformly dark rufous over the entire dorsal surface.

# A Taxonomic Study of Hawaiian Ephydridae (Diptera) related to Scatella Robineau-Desvoidy

By WILLIS W. WIRTH[1]

University of California, Berkeley

*(Presented by E. C. Zimmerman at the meeting of December 8, 1947)*

## INTRODUCTION

The study here reported was begun in 1945, when the writer was stationed by the U. S. Public Health Service as quarantine entomologist in the Hawaiian Islands. Through 1946, numerous collections of aquatic Diptera were made in connection with airport surveillance activities, including many of the interesting family Ephydridae. In addition to the basic studies on Oahu, trips were also made to Kauai and Hawaii, where several species of Ephydridae were collected which are apparently undescribed.

The writer is greatly indebted to Dr. F. X. Williams, entomologist of the Hawaiian Sugar Planters' Association Experiment Station in Honolulu, whose praise-worthy "Biological Studies on Water-loving Insects" of Hawaii is so well known, for his kindly interest and helpful suggestions in the present study. Acknowledgment is also gratefully made to Mr. E. C. Zimmerman of Honolulu for arranging a loan of material from the Bishop Museum and H. S. P. A. collections, and to Dr. Curtis W. Sabrosky for arranging a loan of U. S. National Museum material. Dr. R. L. Usinger of the University of California also offered valuable advice on problems of nomenclature and of insect distribution among the islands of the Pacific.

The first known species of the *Scatella* group from the Hawaiian Islands was described by Grimshaw (1901) as *Scatella hawaiiensis.* Terry gave a manuscript name, *"S. hawaiiensis,* var. *sexnotata,"* to a form which was recorded by Fullaway (1914) from Laysan Island, and by Osborn (1915) from Waikiki, Oahu; this form was finally described by Cresson (1926) as *Scatella sexnotata.* Warren (1914) gave notes on a fly which he called *Ilythea* sp. and which subsequently has been included by other authors with a species from Maui described by Cresson (1926) as *Scatella warreni.* At the same time Cresson also described *S. bryani* and *S. terryi.* In 1935 Malloch erected the genus *Neoscatella* for a species from the Marquesas Islands, and in the same year Cresson transferred the five known Hawaiian species of *Scatella* to this genus. In 1938 Williams gave an excellent account of the biologies of the Hawaiian species of *Scatella,* describing a new species, *S. oahuense.*

[1] Junior Research Fellow, National Institute of Health.

In 1935 Malloch erected the genus *Apulvillus* for a new species, *bronneci,* from the Marquesas Islands, and the genus *Chaetoscatella* for *cheesmanae* from the Society Islands and *unguiculata* Malloch (1934) from Samoa. These genera clearly belong to the *Scatella* group, and they are distinctive by their lack of pulvilli.

In the present study four new species and a new subspecies of *Neoscatella* are described from the Hawaiian Islands. The genus *Apulvillus,* with which *Chaetoscatella* is synonymized, is recorded from Hawaii for the first time, and two new species belonging to this genus are described; the close relationship of these Hawaiian species to *Neoscatella* is also indicated. A brief discussion of the generic classification according to the male genitalia is also given and keys are presented to the genera of the *"Scatella group"* of Ephydridae, to the species of *Apulvillus* and to the Hawaiian species of *Neoscatella.* The types of the new species are in the B. P. Bishop Museum collection; paratypes will be furnished the U. S. National Museum, the California Academy of Sciences and the Academy of Natural Sciences of Philadelphia, while the remainder are in the author's collections. Unless otherwise specified, all material listed here was collected by the writer.

## GENERIC CLASSIFICATION

The present writer, having studied the genera of Ephydridae most closely related to *Scatella,* would characterize this compact group as follows: (1) Second antennal segment without a spinose bristle at upper distal corner, arista bare or pubescent; (2) mesonotum with two or more pairs of dorsocentrals; (3) sternopleural bristle present; (4) face with bristles, the mouth opening large; and (5) costa extending to the fourth vein ($R_{4+5}$). The genera of the *Scatella* group may be distinguished by the following key:

### Key to the Genera of the Scatella Group

1. Pulvilli undeveloped; tarsal claws large.....**Apulvillus** Malloch.
   Pulvilli present; tarsal claws normal ..... 2
2(1). Only one pair of divergent fronto-orbital bristles..**Limnellia** Malloch.
   Two pairs of divergent fronto-orbital bristles..... 3
3(2). Two post-sutural pairs of strong dorsocentral bristles, ante-sutural pair absent; genal bristles strong..**Scatella** Robineau-Desvoidy.
   Three or more pairs of strong dorsocentrals, or if two pairs, there are no long acrostichals..... 4
4(3). Only one pair of long acrostichal bristles, located at the suture, none present post-suturally.....**Neoscatella** Malloch.
   A row of short acrostichal bristles complete post-suturally to base of scutellum..... 5
5(4). Wings with hyaline spots; genal bristle well developed .....**Parascatella** Cresson.
   Wings without hyaline spots; genal bristle undeveloped .....**Lamproscatella** Hendel.

## Male genitalia of the *Scatella* Group

It has been suggested by Cresson that a study of the male genitalia of the genera of Ephydrinae would afford a better basis for classification, but the writer has been unable to find any important references in the literature to such a comparison. Cole (1927) did not treat any of the present genera in his study of dipterous male genitalia. However, Collin (1930) gave figures of the male genital plates of several British species of *Scatella,* Malloch (1925) figured the male genitalia of some Australian species, and Tonnoir and Malloch (1926) of some New Zealand species. Malloch (1925) stated "The hypopygia of the males possess a peculiar feature in this genus [*Scatella*], the claspers being connected about middle by a chitinous band which arches below . . ."

From the writer's study of material of *Scatella, Neoscatella, Apulvillus, Lamproscatella,* and *Limnellia,* the following notes can be given. The male genitalia of the first three genera are quite similar, supporting the opinion that these genera are very closely related (Fig. 1, a-c). The tergites of the male abdominal segments 2-4 are short and subequal in length and extend far ventrad on each side; the corresponding sternites are very much reduced to approximately square dimensions. The fifth tergite is elongated, often as much as twice the length of the fourth, and is tapered and curved caudad, making up the entire apex of the abdomen dorsally. Tergites 7 and 8 are reduced, and the 9th tergite is forced to assume a ventral position due to the enlargement of the 5th, with the apex directed forward and forming two more or less pointed lobes. The 9th tergite extends down on each side around and enclosing the 10th segment. The 10th segment is membranous except for two prominent lobes on each side of the anal opening which Collin calls the "anal lamellae," and Cole the "cerci." Articulating with the dorso-anterior margin of the 9th tergite (fig. 1, b) is a periphallic sclerotization consisting of a pair of anteriorly directed, more or less finger-shaped claspers which are connected by an arched sclerotized band. This band forms a sclerotized arch through which the aedeagus may be thrust or withdrawn; the latter is mostly membranous, but possesses a more or less sclerotized cylindrical sheath, sometimes with a pair of more strongly sclerotized hooks. The aedeagus, supported by a slender ribbonlike dorso-ventrally flattened apodeme (fig. 1, a) bearing a spoon-like or capitate tip, works through this sheath.

In *Lamproscatella quadrisetosa* Becker (fig. 1, d-e) from Contra Costa County, California, the shape of the 9th tergite is essentially as in the above genera, but it meets along the mid-ventral line along a very narrow but heavily sclerotized and laterally compressed ventral or basal arm of the aedeagus and clasping organs. The sclerotized apodeme of the aedeagus is an amber hyaline, arched

mesal blade, very thin distally and broadened basally in lateral view, arising near the level of the ventral extremities of the anal lamellae and extending forward well past the apices of the lobes of the 9th tergite. Arising at the base of this apodeme, and projecting along each side of and slightly arched anterior to it are a pair of very slender bands, straight and lamellate in dorso-ventral view, but very irregular in lateral view, their apices very slender and with a small knob. The claspers articulate basally with the ventral basal arm of the aedeagus, laterally with the lateral margin of the 9th tergite near the distal lobe-like tips, and sub-apically are fused with the membranous area caudad of the 5th sternite, the slender finger-like setose tips remaining free.

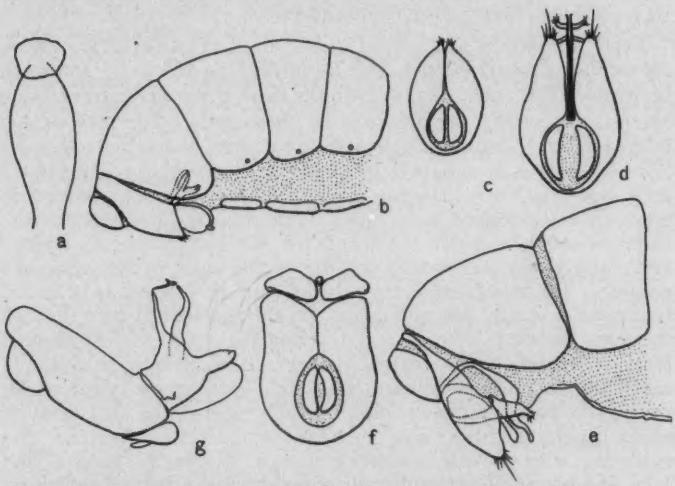


Figure 1. Male genitalia of the *Scatella* group. **a-c**, *Scatella* spp.; **a**, aedeagal apodeme, dorsal view, greatly enlarged; **b**, lateral view of male abdomen; **c**, ventral view of ninth tergite and associated structures.

In *Limnellia sejuncta* (Loew) (fig. 1, f, g) from Berkeley, California, the genitalia are quite different; the 9th tergite is stout and truncated at the apex, with a pair of stout irregular lobes closely appressed to the tergite proper, and with a median, posteriorly directed, stout blade-like hook. The claspers are very heavily sclerotized and prominent, articulating broadly at the base with the apico-lateral margin of the 9th tergite, bearing a distinct lateral ventrally-directed tooth, and a slender irregular tapered dorsal arm which connects with the very small aedeagal apodeme. The aedeagus bears a lateral pair of slender tapering sclerotized plates

arising basad between the bases of the claspers and articulating dorsally with the capitate end of the minute aedeagal apodeme.

## Genus **Neoscatella** Malloch

*Neoscatella* Malloch, 1935, B. P. Bishop Mus. Bull. **114**: 9; Cresson, 1935, Trans. Amer. Ent. Soc. **61**: 359.

Resembles *Scatella,* but differs in the possession of an antesutural dorsocentral bristle. No other characters are known which do not vary to form links with other genera.

Genotype: *Neoscatella atra* Malloch, 1935 (original designation).

Malloch (1935) proposed the genus *Neoscatella* for *atra,* a new species from the Marquesas Is., giving as generic characters, "distinguished from *Scatella* by the possession of three pairs of long dorsocentrals and one long and one short anterior pair of acrostichal bristles. The aristae are more distinctly short-haired than is usual in that genus, the wings lack hyaline spots in the genotype, and the scutellum has four well-developed bristles, the apical pair longer than the lateral pair". Malloch hesitated to give *Neoscatella* full generic rank because of evidence of connecting links between it and *Scatella* and *Lamproscatella.* He also mentioned that Cresson's *Scatella intermedia* from North America appeared to belong to *Neoscatella* and that it was possible that the Hawaiian species belonged here though having spotted wings.

Cresson, in 1935, supported Malloch's treatment of *Neoscatella* as a full genus, stating that the character of the presence of an antesutural dorsocentral was "very positive" and adding, "the lateral seta of the scutellum, is typically strong and basal, but this character varies, becoming a weak curved subapical seta as in *Scatella*". Cresson followed by transferring a number of species previously placed in *Scatella* to *Neoscatella,* including 2 North American species, 4 from South America, the 5 known Hawaiian species, 2 European species, and 1, possibly 2, from Australia, while describing an additional Australian species.

### Key to the Hawaiian species of *Neoscatella.*

1. Wings light, with an irregular subapical dark band (Kauai) ..... **kauaiensis** n. sp.
   Wings dark, usually with more or less definite light spots arranged in a characteristic pattern ..... 2
2(1). Wings with at most faint indication of two light spots ..... 3
   Wings with five or six well-defined light spots ..... 7
3(2). Size large (2.5-3.5 mm.); wings with two faint pale spots; fore tarsi of ♂ not swollen or with long fine hairs or erect bristles (fig. 3, a) (Maui, Hawaii) ..... **warreni** (Cresson).
   Size small (1.6-2.8 mm.); wings very rarely with a faint pale spot; fore tarsi of ♂ usually swollen and club-shaped or with long fine hairs or erect bristles ..... 4

4(3). Fore femora of ♂ swollen and post-flexor bristles reduced (fig. 3, c); fore tarsi of ♂ swollen and club-shaped, less than length of tibiae; genal bristle small (costa without long spines interspersed, wing tapered)..... 5
Fore femora of ♂ normal, post-flexor bristles well-developed (fig. 3, b, d); fore tarsi of ♂ as long as or longer than tibiae, which bear a posterior row of bristles; genal bristle large..... 6
5(4). Fore tarsi of ♂ less than half as long as tibiae, the segments tightly appressed forming a compact club, with thickened erect spines (Hawaii).....**clavipes clavipes** n. sp.
Fore tarsi of ♂ over half as long as tibiae, the segments not forming a compact club, with long slender curved bristles (Oahu) .....**clavipes tenda** n. sbsp.
6(4). Male with post-flexor bristles of fore femora twice as long as diameter of femur, apex of tibia with several long fine hairs, tarsi with abundant long wavy hairs dorsally (fig. 3, d); size smaller (1.5-2 mm.); color not light pollinose gray below (Oahu; Kauai) .....**cilipes** n. sp.
Male with post-flexor bristles of fore femora about as long as diameter of femur, apex of tibiae without long fine hairs, tarsi with erect bristles dorsally (fig. 3, b); size larger (2-2.8 mm.); color light pollinose gray below (Oahu).....**fimbriata** n. sp.
7(2). Wings 6-spotted, spot present in cell $R_1$..... 8
Wings 5-spotted, spot absent in cell $R_1$..... 9
8(7). Small species (2 mm.); dorsocentral bristles 1:2, acrostichals 1:0; mesonotal setulae not well developed; post-flexor bristles of fore femora about as long as diameter of femur (widespread) .....**bryani** (Cresson).
Large species (over 2.5 mm.); dorsocentrals 1:3, acrostichals 1:1; mesonotal setulae prominent; post-flexor bristles of fore femora twice as long as diameter of femora (widespread) .....**sexnotata** (Cresson).
9(7). Color opaque brownish olive (Oahu).....**terryi** (Cresson).
Color shining black above, pollinose toward sides..... 10
10(9). Inner vertical bristles well developed (widespread)..... .....**hawaiiensis** (Grimshaw).
Inner vertical bristles greatly reduced (Oahu, Maui, Hawaii) .....**oahuense** (Williams).

**Neoscatella kauaiensis** Wirth, new species

A large shining, somewhat iridescent, dark brownish black species with moderate development of bristles and setulae; dorsocentrals 1:2 and acrostichals 1:1; wings light with an irregular subapical dark band.

♂, ♀. Frons shining iridescent brownish black with violet and greenish reflections; parafrons and ocellar tubercle dark brown pollinose; fronto-orbitals, inner and outer verticals, and ocellar bristles strong; frontal setulae inconspicuous. Face dark brown pollinose; median facial prominence strongly protruding, arising at level of a line between lower margins of bases of antennae; a diagonal row of five or six strong bristles extends on each side from apex of prominence ventro-laterally well removed from facial margin, the lateral bristle quite strong and latero-reclinate and arising near oral margin; a row of about seven strong setae on each side bordering oral margin; setulae well-developed but scarcely involve the face above the row of facial bristles. Cheeks light gray pollinose, with a strong genal bristle and a posterior patch of strong setulae. Occiput light gray pollinose with a row of short fine setulae curving up over the posterior eye margin. Antennae with third segment about a third longer than broad, with grayish pubescence, second segment with a dorsal seta

and a row of mesal setae the longest of which are nearly as long as third antennal segment; arista about 2.5 times as long as third antennal segment, bare ventrally, dorsally with long pubescence nearly to apex.

Mesonotum and scutellum more or less shining brownish black, with purplish iridescence except at anterior margin which is more greenish; humeri, lateral margins, and most of mesopleura brownish pollinose, remainder of pleura and postnotum grayish pollinose. Three pairs of strong dorsocentrals (1:2) and two pairs of moderate acrostichals (1:1), although some strong anterior and intermediate setulae appear in each series. Scutellum broader than long, with subapical pair of setae about three-fourths as long as the strong apical pair.

Abdomen more or less shining iridescent brownish black without trace of segmental banding; lateral margins of segments gray pollinose, bristling strong, some of the longest half as long as length of third abdominal segment. Male with tergites progressively longer on distal segments, 5th about a quarter longer than 4th; clasper long and slender and distinctly curved at tip (fig. 2, f).

Legs dark brown, the coxae, trochanters, and proximal half to three-fourths of femora grayish pollinose; bristling moderate except a strong series on anterior surface of mid-femora, and the usual strong post-flexor series on fore femora about 1.5 times as long as the diameter of the segment.

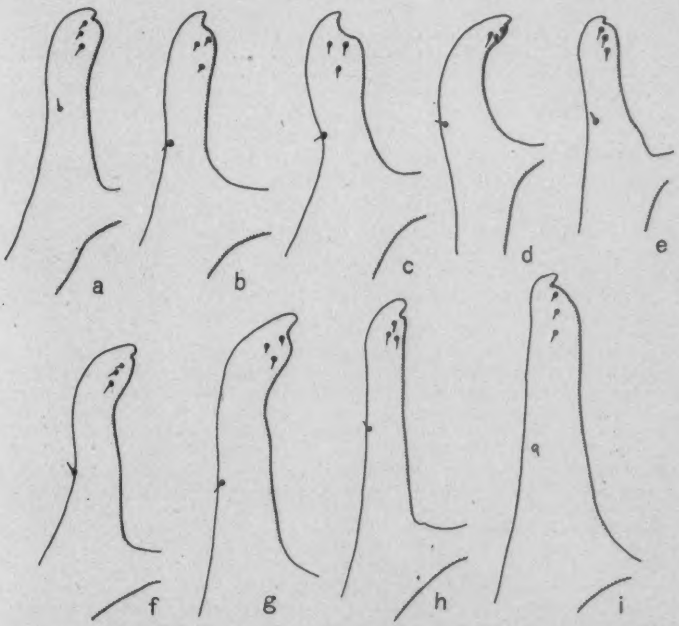


Figure 2. Male claspers of *Neoscatella* and *Apulvillus*. a, *hawaiiensis;* b, *oahuense;* c, *williamsi;* d, *clavipes clavipes;* e, *bryani;* f, *kauaiensis;* g, *warreni;* h, *fimbriata;* i, *sexnotata.*

Wings (Plate VI, figure 1) clear except for very narrow infuscation along the veins and for a more or less prominent dark infuscated irregular subapical band involving distal third of cell $R_1$, cell $R_2+_3$ at same level, and extending nearly or all the way across cell $R_4+_5$ (dark chocolate brown in the ♂, but often quite faint in the ♀). Costal fringe proximad of apex of vein $R_1$ with setae about three times thickness of costal vein; distad of $R_1$ the fringe with short blunt setae about as long as thickness of costal vein interspersed at about every fifth seta with a spinule about twice as long.

Length—2.9 mm. (2.4-3.5); wing—3.0 mm. (2.4-3.7).

Holotype ♂, allotype ♀; paratypes 9 ♂♂, 39 ♀♀; Kokee, Kauai, Sept. 6, 1946 (4000 ft., at falls near tunnel; resting on wet rocks).

This species has the general appearance of *Neoscatella warreni*, differing by the very characteristic subapical dark band of the wings on a light background. In the latter respect *kauaiensis* resembles closely a New Zealand species of *Scatella, nubeculosa* Tonnoir and Malloch (1926), though differing according to their brief description as follows:

1. Size small (body 1.6 mm., wing 2 mm.); infuscation of wing extending to apex; face yellowish brown; mesonotum with traces of pale vittae anteriorly ..... *Scatella nubeculosa*
   Size large (body 2.9 mm., wing 3 mm.); infuscation of wing not extending to apex; face dark brown; mesonotum without trace of pale vittae ..... *Neoscatella kauaiensis*

**Neoscatella warreni** (Cresson)

*Scatella warreni* Cresson, 1926, Proc. Haw. Ent. Soc. **6**: 276; Williams, 1938, Proc. Haw. Ent. Soc. **10**: 102.

*Neoscatella warreni* Cresson, 1935, Trans. Amer. Ent. Soc. **61**: 360 (gen. pos.).

A large subopaque dark brownish black species with slight purplish iridescence; bristles and setulae moderately developed; wings with two faint spots.

♂, ♀. Frons more or less shining brownish black, parafrons and ocellar tubercle pollinose; fronto-orbitals, the inner and outer verticals, and the ocellar bristles well-developed, frontal setulae inconspicuous. Face dark brownish black pollinose, with the facial setulae sparse but strong, a row of about six long setae on oral margin; median facial prominence well-developed, arising at level of a line between lower margin of bases of antennae; a diagonal row of about 4 facial bristles on each side extending ventro-laterally well removed from facial margin, the lower two bristles quite prominent. Cheek with prominent genal bristle. Antennae with the third segment almost as broad as long; arista about twice the length of third antennal segment, bare ventrally, with strong pubescence dorsally nearly to tip.

Mesonotum and scutellum subopaque brownish black, iridescent purplish except on anterior margin which is iridescent greenish; humeri and mesopleura pollinose brown, remainder of pleura and postnotum grayish pollinose; four pairs of dorsocentral bristles (1:3), the second pair small, the others strong; one pair of acrostichals (1:0), with some large setulae post-suturally, other mesonotal setulae sparse, but well developed near anterior margin;

mesopleura with about a dozen small setulae. Scutellum with two pairs of small lateral setulae, a moderate subapical pair which are almost half the length of the strong apical pair of bristles.

Abdomen dark brown with purplish iridescence, no trace of segmental banding. Male with 5th tergite half again as long as 4th, 2nd to 4th subequal; clasper long and slender and distinctly curved at tip (fig. 2, g).

Legs (fig. 3, a) with coxae, trochanters, and proximal three-fourths of femora dark-grayish pollinose, remainder dark brown; bristling moderate, the fore femora with the post-flexor bristles about as long as width of femora.

Wings iridescent purplish brown, lightly infuscated, with two faint spots, one about midway in cell $R_{2+3}$ and the second about a fourth way from apex of cell $R_{4+5}$; veins not undulating; costal fringe distad of tip of vein $R_1$ with short spinules about as long as thickness of costal vein interspersed at every fourth spinule with strong dorsally-directed spines about twice as long. Wing rather slender, about three times as long as greatest width. Halteres yellow.

Length—3.1 mm. (2.5-3.4); wing 3.2 mm. (2.5-3.5) (Hawaii material only).

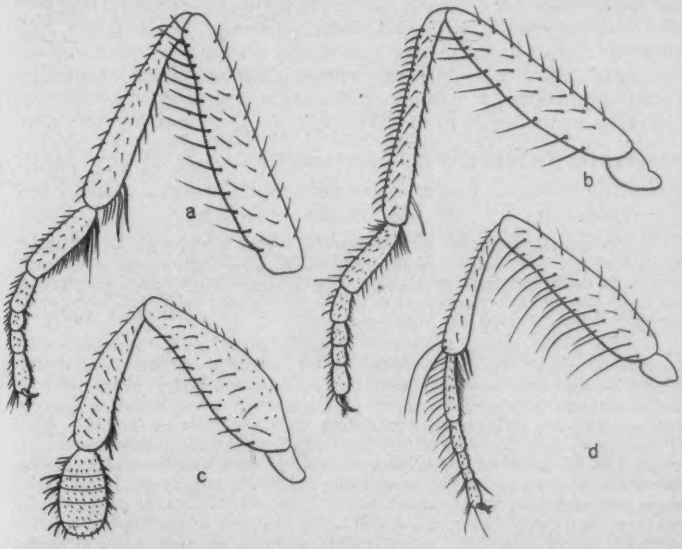


Figure 3. Fore legs of males of *Neoscatella*. **a**, *warreni;* **b**, *fimbriata;* **c**, *clavipes clavipes;* **d**, *cilipes.*

Material examined: Wirth collection. Hawaii: 10 ♂♂, 33 ♀♀, Akaka Falls, March 5, 1946; 3 ♂♂, 7 ♀♀, Rainbow Falls, Hilo, March 3, 1946. Bishop Museum collection. Hawaii: 1 ♂ 1 ♀, Akaka Falls, Oct. 21, 1931, F. X. Williams; 1 ♂, 8 ♀♀, Hilo, July, 1936, F. X. Williams (flume). Maui: 2 ♂♂, 1 ♀, Haipauena, June 25, 1920, E. H. Bryan, Jr. (the ♀ is one of Cresson's para-

types); 2 ♂ ♂ Iao Valley, Jan. 3, 1915, J. F. Illingworth; 1 ♂, Kailua, June 20, 1920, E. H. Bryan, Jr.; 1 ♂, Wailua-iki, July 3, 1920, E. H. Bryan, Jr.

Some specimens from Oahu, determined by Cresson as *warreni*, are smaller than the Maui paratype and the series from Hawaii; they lack the pale wing spots, the fore tibia of the ♂ has the posterior fringe of curved bristles, and they otherwise resemble *fimbriata* of Oahu, to which they are here referred. Williams (1938, p. 106) gives some very excellent notes on the biology of *warreni* from Hawaii, and from several points on Oahu; the latter notes probably refer to *fimbriata*. Of Oahu material treated by Dr. Williams as *warreni*, the writer examined specimens from Kalihi Stream and Waianae which were *fimbriata;* however Williams' figure of the wing of *warreni* from Lulumahu Stream near Honolulu shows one distinct and one faint pale wing spot characteristic of that species. One of Warren's specimens of *"Ilythea"* was also seen and appeared to be *fimbriata*. Williams (*l.c.*) states that *warreni* "varies much in size and, as the smallest forms are often associated, there may be really more than one form involved." With the material at hand it is therefore concluded that *warreni* definitely occurs on Maui and Hawaii, and less certainly on Oahu.

**Neoscatella fimbriata** Wirth, new species

*Scatella warreni*, Williams (in part, not Cresson), 1938, Proc. Haw. Ent. Soc. **10**: 102. (Oahu records.)

A medium-sized species with unmarked wings, costa with longer interspersed spines; color light pollinose gray below; genal bristle well-developed; male with moderate post-flexor bristles on fore femora, fore tarsi not swollen but with erect bristles dorsally, fore tibiae with a row or fringe of moderate curved bristles, no long fine hairs at apex.

♂, ♀. Frons shining iridescent brownish black, parafrons and ocellar tubercle pollinose; the fronto-orbitals, inner and outer verticals, and ocellar bristles strong; frontal setulae minute. Face opaque brownish black with the median protuberance well-developed, with a marked dorsal hump; a diagonal row of about five facial bristles extending ventro-laterally on each side, these all well-developed, progressively larger laterally, the latero-most pair arising about half as far from facial margin as from para-facialia; facial setulae sparse and fine and confined below facial bristles; oral margin fringed with about six moderate setae on each side. Cheeks light grayish pollinose, the genal bristle strong, with a sparse patch of less than a dozen setae on ventro-posterior corner. Antennae with the third segment less than a fourth longer than broad, with grayish pubescence; second segment with a long fine subapical dorsal seta and an apical fringe of moderate to long setae on mesal and ventral sides; arista about twice as long as third antennal segment, bare ventrally with long dorsal pubescence to tip.

Mesonotum and scutellum subopaque iridescent brownish black, humeri and upper half of pleura and postnotum pollinose brownish black, lower portion of pleura pollinose gray; three pairs of strong dorsocentrals (1:2), one pair of strong acrostichals (1:0) with two pairs of weaker setae in line anteriorly; other mesonotal setulae sparse but moderately developed anteriorly. Scutellum with a weak subapical pair of bristles about a third as long as the strong apical pair.

Abdomen dark brownish black with purplish iridescence, without trace of segmental banding; the 5th segment of ♂ bluntly tapered posteriorly, about as long as wide at base and half again as long as 4th, 2nd to 4th subequal; clasper extremely long and slender, more so than in any other Hawaiian species, the apex scarcely bent (fig. 2, h).

Legs (fig. 3, b) with coxae, trochanters, and bases of femora pollinose gray, remainder dark brown; bristling moderate. Fore legs of the ♂ with the femora not markedly swollen, the fore tarsi slightly longer than the tibiae; the postflexor bristles of the femora about as long as diameter of femur; posterior margin of tibia bearing a dense, even fringe of curved bristles slightly longer than thickness of the tibia; dorsal bristles of the tarsi erect and well-developed, about as long as width of tarsal segments; claws normal. Female with ratio of segments of leg as usual in the genus, the post-flexor bristles of the fore femur as in the ♂, the fore tibiae bearing only a sparse even fringe of fine posterior bristles, the tarsal bristles not unusual.

Wings with greatest width about 2.8 the length, not especially tapered apically, evenly infuscated without trace of light spots, veins not undulating; costal fringe distad of tip of $R_1$ of short spinules about as long as diameter of costal vein interspersed at every fourth or fifth spinule with strong dorsally directed spines about twice as long. Halteres with knob yellow, base brownish.

Length—2.5 mm. (2.2-2.8); wing—2.7 mm. (2.3-2.9).

Holotype ♂, Palolo Valley, Oahu, Jan. 19, 1946 (1500 ft.; resting on moist rocks in stream bed). Allotype ♀, Kaluanui Valley, Oahu, May 14, 1946, (at stream, 2000 ft.). Paratypes: 1 ♂, Manoa Valley, Oahu, May 6, 1945; 1 ♂, 2 ♀ ♀, Kaluanui Valley, Oahu, May 14, 1946 (at stream, 2000 ft.); 1 ♂, Mt. Kaala, Oahu, Apr. 17, 1946; 2 ♂ ♂, 4 ♀ ♀, Makaleha, Oahu, Jan. 13, 1929, E. H. Bryan, Jr.; 2 ♂ ♂, 1 ♀, Waianae, Oahu, May 10, 1936, F. X. Williams (swift water ditch). Other specimens: 4 ♀ ♀, Kalihi Stream, Honolulu, Oahu, Mar. 13, 14, 1937, F. X. Williams (wet boulder); 2 ♂ ♂, 6 ♀ ♀, Moanalua, Oahu, Apr. 9, 1922, E. H. Bryan, Jr. (det. *"warreni"* by Cresson); 1 ♀, Palolo, Oahu, Feb. 25, 1922, E. H. Bryan, Jr.; Honolulu, Oahu, Oct. 26, 1913, A. Warren.

This species is intermediate between *clavipes* and *cilipes* on one hand and *warreni* on the other, being nearly as small in size as the former two species and also resembling them in having dark unspotted wings, but differing from them both by the prominent facial hump, shining black dorsal color and pollinose gray ventral aspect, wings not markedly tapering distally, and presence of long spines interspersed on the costa. *Fimbriata* further differs from *clavipes* in lacking the swollen fore femora and tarsi of the ♂ and possession of the long post-flexor femoral bristles and a row of distinct tibial bristles and a long genal bristle, and further differs from *cilipes* in lacking the long apical tibial hairs of the ♂. It differs from *warreni* in lacking the two pale wing spots, in the smaller size, and in possessing well-developed erect bristles on the fore tarsi of the ♂. The earlier confusion of *fimbriata* with Oahu

records of *warreni* is discussed above under *warreni*; it is believed likely that all Oahu records should be referred to *fimbriata*.

**Neoscatella cilipes** Wirth, new species

A small opaque dark brownish black species, with dark unspotted wings; the males with fore femora normal but the post-flexor bristles very long, the fore tibiae with several very long fine apical hairs, and fore tarsi with abundant long fine wavy dorsal hairs.

♂, ♀. General color opaque dark brownish black throughout as in *clavipes*, with purplish and greenish iridescence, only the mesofrons shining; ventral aspect generally dark gray pollinose.

Head with fronto-orbitals, the outer verticals, and ocellar bristles long, the ocellars rather slender, inner verticals about half the length of the outer; frontal setulae minute, alternating with the fronto-orbitals. Median facial prominence rather rounding, the dorsal hump moderate; a diagonal row of about 4 facial bristles extending ventro-laterad on each side from prominence, these well-developed, the latero-most pair strongest and arising midway between oral margin and parafacialia; facial setulae sparse and fine; oral margin with a fringe of about five long fine hairs on each side. Cheeks pollinose gray, with a prominent genal bristle and a sparse patch of about a dozen fine setae on ventro-posterior corner. Antennae with third segment about as broad as long, with grayish pubescence, second segment with apical fringe of fine setae on mesal and ventral sides; arista over twice as long as third antennal segment, bare ventrally, with long dorsal pubescence nearly to tip.

Mesonotum with three pairs of strong dorsocentrals (1:2), one pair of strong acrostichals; mesonotal setulae confined to a few strong ones on anterior and lateral margins. Scutellum with a weak subapical pair of bristles about a third as long as the strong apical pair.

Abdomen without trace of subapical banding, the bristles sparse but rather long, 5th tergite of ♂ only slightly longer than 4th, about a quarter broader than long and bluntly tapered distally, 2nd to 4th subequal.

Legs (fig. 3, d) with bristling moderate on four posterior pairs; fore legs of ♂ with the femora not swollen, with the prominent row of post-flexor bristles about twice as long as thickness of femur and markedly downcurved toward apices; the tibiae with a distinct row of outstanding bristles on posterior edge, these about as long as diameter of tibia, apex with two prominent subapical ventral spines and two apical dorsal long prominent bristles; tarsi subequal to length of tibiae, segments not markedly swollen, abundantly furnished with long fine wavy hairs dorsally, claws normal. In the ♀ the post-flexor bristles of the fore femora are fine and sparse but long and wavy as in the ♂, the tibial bristles are fine and inconspicuous, the ventral spines as in the ♂, but the apical dorsal bristles are short and inconspicuous as well as the dorsal tarsal hairs.

Wings distinctly tapered distally with the greatest width 2.8 the length; evenly infuscated without trace of light spots; veins not undulating: costal fringe distad of tip of $R_1$ of short spinules without any interspersed long dorsally directed spines present. Halteres with yellow knobs, bases brownish.

Length—1.8 mm. (1.6-2.0); wing—1.9 mm. (1.7-2.2).

Holotype ♂, Mt. Kaala, Oahu, July 25, 1946 (4000 ft., bog at summit). Allotype ♀, Waianae, Oahu, Apr. 19, 1936, F. X. Williams (edge of swift water). Paratypes: 1 ♂, Manoa Valley, Oahu, May 6, 1945; 2 ♂ ♂, *idem*, Apr. 10, 1946; 1 ♂, 1 ♀, Waihi-iki, Manoa Valley, Oahu, Feb. 28, 1937, F. X. Williams (wet rock); 1 ♀, Kokee, Kauai, Sept. 7, 1946 (4000 ft.); 2 ♂ ♂, 2 ♀ ♀, Wailua Falls, Kauai, Sept. 4, 1946 (wet rocks at stream margin).

This species resembles *clavipes* in size and color, tapered wing, and lack of long costal spines, but differs in lacking the swollen fore femora and tarsi in the ♂, and in possessing a long genal bristle, the long post-flexor femoral bristles, the row of tibial bristles and the long apical tibial hairs, and in the long hairy vestiture of the tarsi rather than the stout spines of the clubbed-foot of *clavipes*. The females of the two species are almost impossible to separate except for the size of the genal bristle, which is subject to a good deal of variation, but generally is very small in *clavipes* and long in *cilipes*.

**Neoscatella clavipes clavipes** Wirth, new species

A small opaque dark brownish black species, somewhat iridescent, with dark unspotted wings and the males with remarkably modified fore legs, the femora swollen and post-flexor bristles reduced, and the fore tarsi forming a swollen spinose club.

♂, ♀. General color opaque dark brownish black throughout, with purplish or greenish iridescence in certain lights, only the mesofrons shining.

Head with fronto-orbitals, the outer verticals, and ocellar bristles long but rather slender, inner verticals in the type reduced to about half the length of the outer pair, but may be subequal in other specimens; frontal setulae reduced to three minute pairs alternating with the fronto-orbitals. Median facial prominence rather rounding, without the usual marked dorsal hump; the diagonal row of five facial bristles extending ventro-laterally on each side, of which only the latero-most pair are conspicuous, these arise about midway between oral margin and parafacialia and are bent outward and slightly upward; facial setulae few and confined below facial bristles; oral margin with a row of about five moderate setae on each side. Cheeks with a patch of setae on ventro-posterior corner, without a prominent genal bristle. Antennae with third segment less than a fourth longer than broad; second segment with a few small apical setae on ventro-mesal corner; arista less than 1.5 times as long as third segment, bare ventrally, with long dorsal pubescence to tip.

Mesonotum with three pairs of strong dorsocentrals (1:2) and one pair of strong acrostichals (1:0); mesonotal setulae absent except for a few on anterior margin and humeri. Scutellum with a weak subapical pair of bristles about a third as long as the strong apical pair.

Abdomen without trace of segmental banding, the bristling not conspicuous. Male with 5th tergite slightly longer than 4th, bluntly tapering distally; 2nd to 4th subequal; clasper very short and markedly and evenly curved to apex (fig. 2, d).

Legs (fig. 3, c) with rather short bristles, the post-flexor series of the fore femora not developed. The fore legs remarkably developed; ♀ with the fore femora slightly thicker than usual in the genus and the tarsi much shorter than usual; ♂ with the femora greatly swollen with a greatest thickness of about a quarter the length, the tarsal segments remarkably shortened, swollen, and appressed, together forming an oval spinose club-like organ about 0.44 as long and half again as broad as the tibia; the claws more or less atrophied and the dorsal setae across each tarsal segment greatly developed forming strong erect protruding spines.

Wings distinctly tapered distally with greatest width about 0.37 of the length; evenly infuscated without trace of light spots; veins not undulating; costal fringe distad of tip of vein $R_1$ of short spinules about as long as thickness of costal vein, no long differentiated spines present. Halteres yellow.

Length—1.9 mm. (1.6-2.3); wing—2.1 mm. (1.7-2.4).

Holotype ♂, allotype ♀, Akaka Falls, Hawaii, March 5, 1946. Paratypes: 36 ♂ ♂, 35 ♀ ♀, same data as the types; 7 ♂ ♂, 15 ♀ ♀, Rainbow Falls, Wailuku River, Hilo, Hawaii, March 2, 1946.

One damaged specimen from Akaka Falls, collected by Dr. F. X. Williams and in the H. S. P. A. collection probably belongs here. *N. clavipes* exhibits the most extreme modifications of the variable structures possessed by the group of very small Hawaiian species with unspotted wings. The most striking of these are the remarkably swollen and modified fore femora and tarsi; others are the reduced median facial prominence, genal bristle, mesonotal setulae, the opaque dark color and the lack of long costal spines. In all the species of this group the modifications of the fore legs are confined to the male sex; the legs of the females are quite normal, and consequently, this sex may be very difficult to determine. There are 10 ♂ ♂ in the author's collection from both localities of Hawaii in which the fore legs are quite unmodified as in the ♀ of *clavipes;* furthermore in 5 of these and in another female there is a faint pale wing spot in the center of cell $R_{2+3}$; in all other respects these individuals resemble typical *clavipes* quite closely and, of course, some of the females placed in *clavipes* may belong to these males without wing spots. These possibly may be a variety of *clavipes* if they are the result of a recurrent genetic segregation of the obviously variable factors affecting the structure of the fore legs and wings. On the other hand the present collection can scarcely be said to represent an adequate sample of the population and it is therefore possible that two distinct species may be represented. The solution of this problem then must await further collecting and study.

**Neoscatella clavipes tenda** Wirth, new subspecies

♂, ♀. As in typical *clavipes,* with the following differences: Inner vertical bristles nearly as long as the outer pair; the facial bristles more conspicuous. Fore tarsi (Plate VI, figure 2) of ♂ about 0.75 the length of tibiae, the segments shortened and swollen, their thickness being slightly greater than that of apex of tibia; each segment bearing dorsally and ventrally a number of long bristles with curved tips, these slightly longer than thickness of tarsal segments; tarsal claws distinct but of distorted shape.

Length—1.8 mm. (1.7-2.0); wing—2.2 mm. (2.1-2.2).

Holotype ♂, allotype ♀, paratype 1 ♂, Kaluanui Valley, Oahu, May 14, 1946 (2000 ft.).

The three specimens are quite distinct from the three specimens of *fimbriata* collected at the same time and place, possessing the swollen and modified fore femora and tarsi in the ♂, the dark color and the reduced genal bristle of *clavipes.* It is believed that their differences from the typical sub-species given in the above description, together with their isolated occurrence on Oahu, warrant making them a subspecies of *clavipes.*

**Neoscatella bryani** (Cresson)

*Scatella bryani* Cresson, 1926, Proc. Haw. Ent. Soc. **6**:276; Williams, 1938, Proc. Haw. Ent. Soc. **10**: 102.

*Neoscatella bryani* Cresson, 1935, Trans. Amer. Ent. Soc. **61**: 360 (gen. pos.).

Type: ♂, Awaawapuhi, Kauai; in Bishop Museum collection.

A small somewhat shining dark brown species with six-spotted wings including a spot in cell $R_1$; almost no mesonotal setulae and bristles not well-developed.

♂, ♀. Frons shining brown, parafrons and ocellar tubercle brown pollinose; the fronto-orbitals, inner and outer verticals, and ocellar bristles strong; frontal setulae inconspicuous. Face brownish pollinose; the facial setulae fine and short, confined below the diagonal row of 4-5 facial bristles extending ventro-laterally on each side from the apex of facial prominence to near oral margin, the ventral bristle of this series moderate, arising about twice as far from the lateral margin as from oral margin; the latter with about five moderate setae on each side. Cheeks gray pollinose, with a strong antero-directed bristle and behind this a small patch of fine setae on lower margin. Antennae with third segment about a third again as long as broad at base; setae of second segment fine; arista about twice as long as third antennal segment, bare below, finely pubescent above almost to tip.

Mesonotum and scutellum shining dark brown, slightly pollinose, becoming greenish on anterior margin and humeri; pteropleura and posterior portion of mesopleura brownish pollinose, remainder of pleura and postnotum dark gray pollinose. Three pairs of well developed dorsocentrals (1:2), one pair of moderate acrostichals (1:0); mesonotal setulae confined to a few minute setulae on anterior portion; a subapical pair of scutellar bristles which are about a third as long as apical pair.

Abdomen opaque dark brown, with faint indication of apical segmental bands, the setae not conspicuous; fourth and fifth tergites subequal in length, the fifth abruptly tapered to a blunt point; clasper short, the tip straight (fig. 2, e).

Legs dark brown, the coxae, trochanters, and proximal three-fourths of femora grayish pollinose; the bristling short, the post-flexor bristles of fore femora about as long as diameter of femora.

Wings lightly infuscated; with six faint spots located as follows: one at base of cell $R_1$, second midway in cell $R_{2+3}$, third about a quarter way from base and fourth about a quarter way from apex of cell $R_{4+5}$, the fifth at apex of cell M and sixth at base of cell $M_1$; some specimens may have two additional spots at apices of cells $R_{2+3}$ and $R_{4+5}$ very faintly indicated; veins distinctly undulating at the spots. Costa with a fringe of short setae, these about as long as thickness of costal vein. Halteres yellow.

Length—2.0 mm. (1.7-2.5); wing—2.1 mm. (1.7-2.4).

Material studied: Oahu: 5 ♂ ♂, 6 ♀ ♀, Kahuku, Feb. 1, 1946 (light trap); 1 ♀, Hering Valley, April 29, 1945; 1 ♀, Honolulu, April 2, 1923, E. H. Bryan, Hawaii: 1 ♀, Hawaii National Park, Kilauea, Oct. 1946, C. J. Davis (light trap).

According to Williams (1938, p. 100) who gives notes on the biology, *bryani* is found generally in lowland situations where there is standing water, from saline flats near the sea, lowland reservoirs, ponds, puddles, and ditches. The author's collections indicate further that *bryani* may invade higher altitudes (Kilauea is about 4000 ft.) and running streams (as at Hering Valley). The specimen from Kilauea was atypical however, in possessing the two

extra faint apical wing spots as indicated by Williams (1938, plate V, fig. 25) and was the only specimen seen by the writer with these spots at all apparent.

Of the Hawaiian species, *bryani* resembles *sexnotata* in possessing six-spotted wings, but differs greatly in its smaller size, reduced condition of bristles and setulae, and shining black color.

**Neoscatella sexnotata** (Cresson)

*Scatella sexnotata* Cresson, 1926, Proc. Haw. Ent. Soc. **6**: 275; Williams, 1938, Proc. Haw. Ent. Soc. **10**: 100.

*Neoscatella sexnotata* Cresson, 1935, Trans. Amer. Ent. Soc. **61**: 360 (gen. pos.).

Type: ♂, Waimanalo, Oahu; in Bishop Museum collection.

A dark opaque species, with well-developed bristles and setulae; the wings with six light spots including one in cell $R_1$.

♂, ♀. Mesofrons shining black, parafrons, anterior margin, and ocellar tubercle distinctly pollinose; fronto-orbitals strong, alternating with three strong setulae, inner and outer verticals strong, two strong lateroclinate anterior ocellars and a moderate median proclinate posterior ocellar bristle. Face distinctly brownish gray pollinose; facial setulae strong and numerous, most strongly developed toward oral margin where there is a row of about seven strong oral bristles on each side; median facial prominence distinctly protruding, three pairs of facial bristles in a diagonal row extending from this prominence to ventro-lateral corner of face, the lateral pair quite strong. Cheeks grayish pollinose; genal bristle strong. Antennae with third segment nearly as broad as long; setae of second segment strong; arista slightly more than twice as long as third segment, with fine pubescence below on basal fourth and above on basal two-thirds.

Mesonotum dark sub-opaque brown, with grayish green pollinosity most pronounced on anterior margin and on humeri; four pairs of strong dorsocentrals, the second located just behind the suture and more or less reduced (1:3); two pairs of strong acrostichals (1:0); mesonotal setulae very prominent on anterior portion, reduced posteriorly. Pleura and postnotum dark brownish gray pollinose; mesopleura with numerous strong setulae. Scutellum with subapical bristles about half as long as the strong apical pair.

Abdomen opaque brownish black, with distinct broad grayish green banding on apices of segments. Fifth tergite of ♂ half again as long as fourth, second to fourth subequal; clasper stout, long, and straight (fig. 2, i).

Wings infuscated with six definite pale spots located as follows: a spot at base of cell $R_1$, second midway in cell $R_{2+3}$, third at basal fourth and fourth at distal fourth of cell $R_{4+5}$, fifth at apex of cell M, and sixth at base of cell $M_1$; veins slightly undulating at the spots; costal fringe distad of tip of vein $R_1$ with short spinules slightly longer than thickness of costal vein alternating at every fifth spinule with strong dorsally-directed spines about twice as long. Halteres yellow.

Length—2.8 mm. (2.5-3.2); wing—2.7 mm. (2.2-3.4).

Material examined: Oahu: 5 ♂♂, 6 ♀♀, Kalihi, Feb., 1946 (light trap); 1 ♂, 5 ♀♀, Kahuku, Feb. 1, 1946 (light trap); 3 ♀♀, Kaneohe, March 13, 1946 (marshy bay shore); 2 ♂♂, Waimea, Jan. 31, 1946 (on rocks by sea); 20 ♂♀, Ewa, March 14, 1946 (on stranded seaweed on beach).

According to Bryan (1934), *sexnotata* has been taken from Oahu, Hawaii, Nihoa, Necker, and Laysan Islands in the Ha-

waiian chain. Williams (1937) states that this species favors stagnant saline pools, such as are formed by high tides, marshes, mudflats, wet beach sand, and tide rocks, and even in reservoirs near the sea. Resembling *bryani* in having six-spotted wings, *sexnotata* differs in its larger size, better developed bristles and setulae, and its opaque brownish color.

**Neoscatella terryi** (Cresson)

*Scatella terryi* Cresson, 1926, Proc. Haw. Ent. Soc. **6**:275; Williams, 1938, Proc. Haw. Ent. Soc. **10**:100.

*Neoscatella terryi* Cresson, 1935, Trans. Amer. Ent. Soc. **61**:360.

Type: ♂, Wawamalu Beach near Koko Crater, Oahu; in Bishop Museum collection.

A robust dull olive-brown species with sparse mesonotal setulae and wings with five spots, none of which are in cell $R_1$.

♂, ♀. General color dull olivaceous brown, the notopleura, postnotum, and apical margins of abdominal segments more grayish.

Head broad, the frons about half again as broad as long, the fronto-orbitals, the inner and outer verticals, and the ocellar bristles rather long but slender. Face protrudes in a rounded prominence located well up between bases of antennae; the facial setulae small and sparse; a diagonal row of facial bristles extending ventro-laterad at about width of parafacialia from facial margin, the lateral bristle of this row moderately strong; a row of six to seven oral setae on each side along oral margin. Antennae with third segment about a fourth longer than wide, the second segment almost devoid of setae; arista scarcely twice the length of third antennal segment, without apparent pubescence.

Mesonotum with three pairs of strong dorsocentrals (1:2) and a pair of moderate acrostichals (1:0); mesonotal setulae sparse and confined to anterior and lateral margins. Scutellum with the subapical pair of bristles about a third as long as the strong apical pair.

Abdomen without trace of segmental banding; fifth tergite of ♂ about half again as long as fourth, second to fourth subequal.

Legs short, the bristles moderate to short except those on mid femora and on fore femora, which are about as long as diameter of femora.

Wings brownish infuscated, with five well-defined light spots as follows: one about midway in cell $R_{2+3}$ of which there is a trace in the anterior margin of cell $R_{4+5}$, which also has a second spot at basal fourth and a third at distal fourth, fourth spot at apex of cell M and a fifth at base of cell $M_1$; all veins with distinct undulations at the spots; costal fringe distad of tip of vein $R_1$ of short spinules about as long as thickness of costal vein. Halteres yellow.

Length—2.5 mm. (2.3-2.8); wing—2.3 mm. (2.2-2.7).

Material examined: Oahu: 2 ♂ ♂, 2 ♀ ♀, Waimea, Jan. 15, 1946 (on rocks by sea); 1 ♂, Hanauma Bay, Jan. 4, 1946 (on rocks by sea).

Apparently this species is known only from Oahu, the type being from the beach near Koko Crater, and Williams (1938) has recorded specimens from the rocks at Waianae. The writer took the Waimea specimens in company with *sexnotata*, which they superficially resemble in their opaque brownish color, but differ with respect to their five-spotted wings and reduced mesonotal setulae.

**Neoscatella hawaiiensis** (Grimshaw)

*Scatella hawaiiensis* Grimshaw, 1913, Fauna Hawaiiensis **3**: 49; Williams, 1938, Proc. Haw. Ent. Soc. **10**: 104.

*Neoscatella hawaiiensis* Cresson, 1935, Trans. Amer. Ent. Soc. **61**: 360 (gen. pos.).

Types: 8 ♂ ♂, 6 ♀ ♀, Mt. Kaala, Oahu, 2000 ft.

A shining black species with five-spotted wings, no spot in cell $R_1$, almost no mesonotal setulae, and well developed inner vertical bristles.

♂, ♀. Frons shining black, parafrons brownish pollinose; the fronto-orbitals, the inner and outer verticals, and ocellar bristles well developed, frontal setulae inconspicuous. Face about a third of total width of head, brownish pollinose; facial setulae fine and sparse, becoming somewhat longer and denser toward oral margin, this with a row of about six moderately long oral setae on each side. Median facial prominence not markedly protruding, a row of four pairs of facial bristles extending diagonally on each side ventro-laterad from prominence, the two lower pairs strong. Cheeks grayish pollinose. Antennae with the third segment about a fourth longer than wide; the arista about twice as long as third antennal segment, with ventral pubescence on proximal third, dorsal pubescence to tip.

Mesonotum and scutellum shining black, brownish at extreme lateral margins, humeri grayish pollinose; three pairs of strong dorsocentrals (1:2), one pair of acrostichals just before the suture (1:0); mesonotal setulae restricted to a few at humeral margins. Pleura dark grayish pollinose, the pteropleura and posterior portion of mesopleura brownish. Subapical pair of scutellar bristles nearly half as long as apical pair.

Abdomen opaque brownish black with scarcely a trace of segmental banding, fifth tergite of ♂ a fifth longer than fourth which is slightly longer than third; clasper moderate, the tip slightly curved (fig. 2, a).

Legs dark brown, the coxae, trochanters and all but apices of femora dark grayish pollinose; the bristles moderate, fore femora with post-flexor bristles slightly longer than diameter of femur.

Wings infuscate, with five definite pale spots as follows: one about midway in cell $R_{3+5}$, second at basal fourth and third at distal fourth of cell $R_{4+5}$, fourth at apex of cell M, and fifth at base of cell $M_1$; the veins distinctly undulating at the spots; costa with the fringe of fine spinules about as long as thickness of costal vein.

Length—2.4 mm. (2.0-2.8); wing—2.6 mm. (2.2-2.9).

Material studied: From the author's collection: Oahu: Mt. Kaala (*topotypic*), Mar., 1946, 3 ♂ ♂, 1 ♀; Apr. 17, 1946, 2 ♀ ♀; July 25, 1946, 3 ♀ ♀ (bog at summit, 4000 ft.); 1 ♂, 1 ♀, Kaluanui Valley, May 14, 1946 (at stream, 2000 ft.); 1 ♂, 2 ♀ ♀, Hering Valley, Apr. 29, 1945; Manoa Valley, May 6, 1945, 2 ♂ ♂; Apr. 10, 1946, 3 ♂ ♂, 2 ♀ ♀; Oct. 19, 1946, 1 ♀. Hawaii: 1 ♀, Ohaikea Pond, Hawaii National Park (4200 ft.), Mar. 4, 1946. Kauai: 1 ♂, Kokee, Sept. 6, 1946 (4000 ft., at falls near tunnel). From the Bishop Museum and H. S. P. A. collections: Oahu: 7 ♀ ♀, Waianae Mts. (Illingworth); 2 ♂ ♂, 2 ♀ ♀, Palolo Falls, July, 1916 (Illingworth); 1 ♂, Moanalua, Apr. 9, 1922 (Swezy); 3 ♂ ♂, 7 ♀ ♀, Makaleha, Jan. 13, 1929 (Bryan); 3 ♂ ♂, 4 ♀ ♀, Niu, Jan. 13, 1924 (Swezy). Kauai: 1 ♀, Awaawapuhi, June 16, 1922 (Bryan). Maui: 1 ♂, Haleakala, Mar. 22, 1932 (Bryant); 1 ♀,

Olinda, Mar. 15, 1932 (Bryant); 1 ♀, Kula Pipe Line, 5000 ft. (Bryant).

Of the Hawaiian species with five-spotted wings, *hawaiiensis* is readily separted from *terryi* by its blackish color compared with the brownish olive color of the latter; and from *oahuense* by the inner vertical bristles which are strong in *hawaiiensis* and reduced in *oahuense*. This species quite closely resembles the very widely distributed genotype of *Scatella, stagnalis* (Fallen), but the presence of an ante-sutural dorsocentral in *hawaiiensis* will readily separate the two species which fall into separate genera on this criterion.

**Neoscatella oahuense** (Williams), new combination

*Scatella oahuense* Williams, 1938, Proc. Haw. Ent. Soc. **10**: 107.

Type: ♀, Hering Valley, Tantalus, Oahu; in Hawaiian Entomological Society collection.

A shining black species, wings with five rather faint spots, none of which are in cell $R_1$, greatly reduced inner vertical bristles, and post-flexor bristles of fore femora poorly developed.

♂, ♀. Frons shining black, parafrons brownish pollinose; the fronto-orbitals, and outer vertical bristle strong, inner verticals very weak and inconspicuous, two strong ocellars; frontal setulae inconspicuous. Face nearly half total width of head, brownish pollinose; median facial prominence moderately projecting, facial setulae short and fine, less than half as long as width of third antennal segment, confined below the oblique row of four facial bristles extending ventro-laterad on each side, the lateral pair strong; oral margin with five to six moderate setae on each side. Cheeks grayish pollinose; genal bristle strong. Antennae with third segment slightly longer than broad; arista about twice as long as third antennal segment, with fine dorsal pubescence extending to tip.

Mesonotum and scutellum shining black becoming brownish pollinose on sides; three pairs of strong dorsocentrals (1:2), one pair of acrostichals (1:0); mesonotal setulae confined to anterior margin. Posterior portion of mesopleura brownish pollinose, remainder of pleura, humeri, and postnotum grayish pollinose. The subapical pair of scutellar bristles about a third the length of the strong apical pair.

Abdomen opaque brownish black with scarcely a trace of segmental banding, 5th tergite of ♂ long and tapering, half again as long as 4th which in turn is longer than 3rd; clasper moderate, slightly bent (fig. 2, b; plate VII, figure 2).

Legs dark brown, the coxae, trochanters, and basal three-fourths of femora grayish pollinose; the bristles short; fore femora with only a few moderate post-flexor bristles near apex, these shorter than diameter of femur; pulvilli shorter and tarsal claws rather larger than usual in the genus.

Wings infuscated, with five rather faint pale spots as follows: one midway in cell $R_{2+3}$, second near base and third about two-thirds way to apex of cell $R_{4+5}$, fourth at apex of cell M, and fifth at base of cell $M_1$; the veins only slightly undulating at the spots; costa distad of tip of $R_1$ with fringe of short setae about as long as thickness of costal vein.

Length—2.4 mm. (2.0-2.8); wing—2.8 mm. (2.3-3.1).

Material studied: Oahu: 1♂, 5♀♀, Manoa Valley, May 6, 1945; 1♂, *idem*, Jan. 19, 1946 (on moist rocks in stream); 7♂♂, 4♀♀, Palolo Falls, July, 1916, (Illingworth); 4♂♂, Niu, Jan. 13, 1924, O. H. Swezey (waterfall).

This species was found by Williams on Oahu, Maui, and Hawaii, at altitudes up to and above 8000 ft. Its habitat coincides with that of *hawaiiensis,* so far as known, for the most part in and along mountain streams, wet banks, and the like, and very common at moderate elevations. The adults can be readily distinguished from *hawaiiensis* by the reduced inner vertical bristles, and in addition the wing spots are less distinct and the veins only slightly undulating at the spots.

It is believed that the related genus *Apulvillus* Malloch may possibly have arisen from *oahuense* or an ancestral species similar to it. Evidence pointing to this conclusion is summarized under the discussion of the genus *Apulvillus.*

## Genus **Apulvillus** Malloch

*Apulvillus* Malloch, 1935, B. P. Bishop Mus., Bull. **114**: 197.

*Chaetoscatella* Malloch, 1934, Insects of Samoa, pt. **6,** fasc. 8, p. 322 (*nomen nudum*); 1935, B. P. Bishop Mus. Bull. **114**: 199. New synonymy.

Pulvilli undeveloped, tarsal claws large; face with the facial series of bristles reduced, only the lateral pair strong, if any; facial setulae very short and fine; wings not spotted.

Genotype: *Apulvillus bronneci* Malloch 1935 (original designation).

Malloch first described the genus *Chaetoscatella* for *cheesmanae,* from the Society Islands. A short time later he described a second species, *unguiculata,* from Samoa. In neither paper did he definitely designate a genotype, though in the discussion of the Samoan species he stated that the genotype was from the Society Islands. The paper including the description of the genus and the Society Islands species was unfortunately delayed in publication and did not appear until 1935, a year later than the Samoan paper (1934). Thus according to one way of thinking, the genus might be considered to be monobasic and to date from 1934, the first publication of the genus, with *unguiculata* as the type. However according to Article 25 of the International Code, since the publication appeared subsequent to 1931, a definite unambiguous designation of the type species is required, and the 1934 paper indicated that the author considered the genotype to be the species from the Society Islands, which at the time was unpublished. The most desirable course at present then seems to be to follow Malloch's intent, and to designate *cheesmanae* as the genotype of *Chaetoscatella.*

The two Hawaiian species of *Apulvillus* are clearly related to Malloch's genera to the south, linking them to *Neoscatella.* Taxonomically one might preserve both of Malloch's genera, but it would be necessary to erect a third genus for the two Hawaiian

species. A much better course seems to be that followed herein: to group the lot in one genus for which the name *Apulvillus* is selected, and to recognize three segregates of the genus, which are treated as groups until more species may become known, when it may be desired to give them subgeneric rank.

The discovery of the two new representatives of *Apulvillus* in Hawaii at this time raises some very interesting problems of relationship and distribution which unfortunately cannot definitely be solved until the faunae of many more Pacific island groups are much better known. Based on the study of the known species of the genus, the analysis of characters shown in Figure 5 presents rather strong evidence that the genus is related to *Neoscatella* through *N. oahuense* or some ancestral species similar to it. The trend of variation in the Hawaiian species from *N. oahuense* through *Apulvillus mauiensis* to *A. williamsi* is clear; *A. bronneci* carries out this trend of variation of characters. From the distributional standpoint, it is puzzling to find what one would term annectant types in Hawaii, and distribution to the southeast from there. In most groups the ancestral types of Oceanic species are generally found in the southwestern Pacific, Australia, or New Guinea or thereabouts, and distribution procedes therefrom by two main routes, the one to the northeast toward Hawaii, and the other to the southeast toward the Marquesas Islands and other groups (Usinger, 1941). Possibly the distribution of *Apulvillus* from Hawaii to the south might be explained by their being carried as eggs on the feet or bodies of some migrating shore-birds (as suggested in a general way by Zimmerman, 1942, p. 10). Until the species of additional island groups, and particularly the New Guinea area, are better known, the present phylogeny should be regarded as highly speculative.

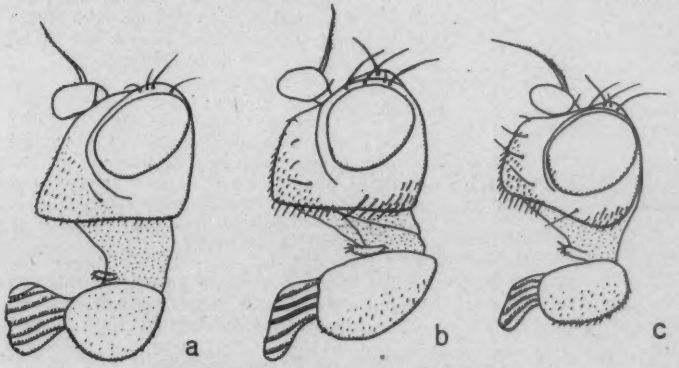


Figure 4. Comparison of heads in lateral view, of **a**, *Apulvillus bronneci;* **b**, *Apulvillus williamsi;* and **c**, *Neoscatella oahuense.*

## Key to the known species of *Apulvillus* Malloch

1. Face perpendicular, forming an angle of nearly 90° with the oral margin; with a prominent median hump or elevation just below level of bases of antennae as in *Neoscatella* (fig. 4, b) (Hawaiian Is.) Group A. *mauiensis* Group ..... 2
   Face long and oblique; the median prominence reduced (fig. 4, c) (South Pacific) ..... 3
2(1). Ocellar bristles strong; anterior dorsocentrals strong; one strong antesutural acrostichal (Maui) ..... **mauiensis** n. sp.
   Ocellar bristles weak; anterior dorsocentrals weak; two weak acrostichals (Hawaii) ..... **williamsi** n. sp.
3(1). Ocellar bristles minute; fourth tarsal segment with an apical pair of long ventral bristles; costa without long differentiated spines; female with fore femora emarginate below (Marquesas Is.) Group B. *Apulvillus* Mall., *s. str.* ..... **bronneci** Malloch.
   Ocellar bristles strong; fourth tarsal segment without long apical bristles; costa with some widely spaced spines much longer than diameter of costal vein. Group C. *Chaetoscatella* Mall. ..... 4
4(3). Knob of halteres yellow (Samoa) ..... **unguiculata** Malloch.
   Knob of halteres black (Society Is.) ..... **cheesmanae** (Malloch).

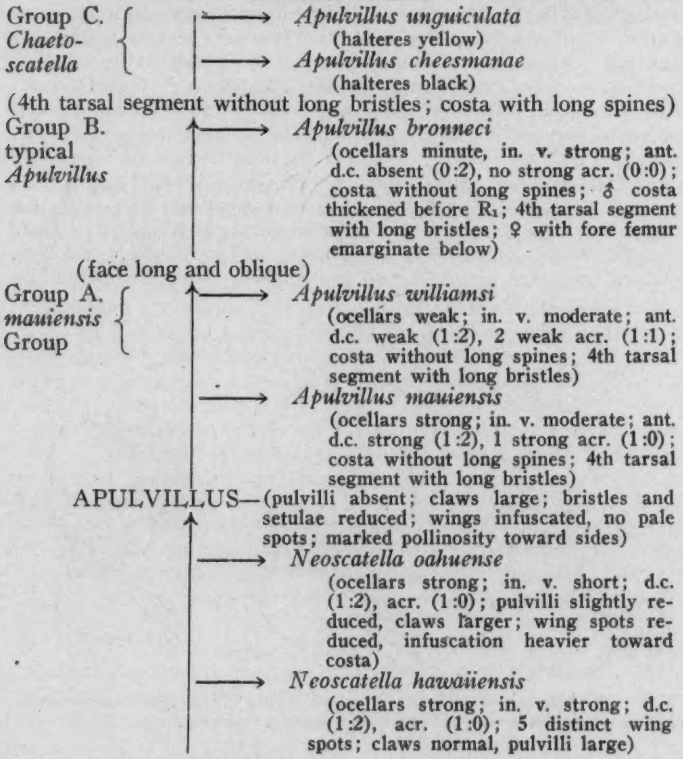
Group C. Chaeto-scatella
Apulvillus unguiculata
(halteres yellow)
Apulvillus cheesmanae
(halteres black)
(4th tarsal segment without long bristles; costa with long spines)
Group B. typical Apulvillus
Apulvillus bronneci
(ocellars minute, in. v. strong; ant. d.c. absent (0:2), no strong acr. (0:0); costa without long spines; ♂ costa thickened before R1; 4th tarsal segment with long bristles; ♀ with fore femur emarginate below)
(face long and oblique)
Group A. mauiensis Group
Apulvillus williamsi
(ocellars weak; in. v. moderate; ant. d.c. weak (1:2), 2 weak acr. (1:1); costa without long spines; 4th tarsal segment with long bristles)
Apulvillus mauiensis
(ocellars strong; in. v. moderate; ant. d.c. strong (1:2), 1 strong acr. (1:0); costa without long spines; 4th tarsal segment with long bristles)
APULVILLUS—(pulvilli absent; claws large; bristles and setulae reduced; wings infuscated, no pale spots; marked pollinosity toward sides)
Neoscatella oahuense
(ocellars strong; in. v. short; d.c. (1:2), acr. (1:0); pulvilli slightly reduced, claws larger; wing spots reduced, infuscation heavier toward costa)
Neoscatella hawaiiensis
(ocellars strong; in. v. strong; d.c. (1:2), acr. (1:0); 5 distinct wing spots; claws normal, pulvilli large)

**Table 1. Relationships of the genus Apulvillus Malloch.**

**Apulvillus williamsi** Wirth, new species

A large pollinose black species with bristles and setulae very much reduced; ocellars weak, inner verticals moderate; anterior dorsocentrals weak, two weak acrostichals; costa without long spines; fourth tarsal segment with long bristles.

♂, ♀. Head (fig. 4, b) with mesofrons shining black, lateral and anterior margins and ocellar tubercle pollinose black; the two pairs of fronto-orbitals, the outer verticals, and ocellar bristles moderate, inner verticals about half the length of the outer. Face pollinose dark brown, grayish pollinose below the antennae; median facial prominence broadly rounding, the diagonal row of facial bristles extending ventro-laterad from prominence, these minute except for the moderate lateroclinate latero-most pair; facial setulae minute, densest toward oral margin which is fringed by a row of eight to ten small bristles. Cheeks gray pollinose, with a moderate genal bristle and a sparse ventro-posterior patch of setulae. Antennae with third segment about a fourth longer than broad, grayish pubescent; second segment with a small subapical dorsal seta and a ventral apical fringe of setulae; arista stout at base, about half again as long as third segment, bare below, with a strong pubescence above about three-fourths way to tip.

Mesonotum and scutellum shining black, faintly iridescent violet pollinose; a weak anterior and two strong posterior dorsocentrals (1:2); two pairs of weak acrostichals (1:1); and a few scattered mesonotal setulae in line with each row of bristles. Mesopleura, pteropleura, and postnotum dark grayish brown pollinose, remainder of pleura gray pollinose; two strong notopleurals, a strong posterior mesopleural and a strong central sternopleural bristle; pleura otherwise bare except for a few scattered minute setulae on mesopleura. Scutellum with the subapical pair of bristles about half as long as the strong apical pair.

Abdomen subopaque dark brownish black with violet iridescence; without segmental banding; the bristles moderate; grayish pollinose below posteriorly. Male with fifth tergite tapered and rounding apically, about half again as long as fourth which in turn is distinctly longer than third; clasper short and bent, with enlarged tip and prominent apical incision (fig. 2, c; plate VII, figure 1).

Legs opaque dark brownish black, the coxae, trochanters, and femora grayish pollinose; bristling very much reduced, fore femora practically bare; fifth tarsal segment twice as long as fourth in both sexes, apical bristles of fourth segment half as long as and appressed to the fifth segment; tarsal claws long and curved and pulvilli reduced as in the genus.

Wings brownish hyaline with brownish black veins, without markings; veins not undulating; costa not particularly thickened between apices of humeral cross-vein and tip of Sc; $R_{s+s}$ and $R_{4+5}$ not more closely approximated at apices in either sex; costa distad of tip of $R_1$ with even fringe of spinules about as long as thickness of costal vein, not interspersed with longer spines. Halteres brown at base, apex yellow.

Length—2.9 mm. (2.4-3.1); wing—3.2 mm. (2.9-3.5).

Holotype, ♀; allotype, ♂; paratypes, 3♂♂, 4♀♀; Akaka Falls, Hilo, Hawaii, March 5, 1946.

These specimens were taken in company with *Neoscatella warreni*, which they resemble superficially in size and color, and also *N. clavipes*, while resting on wet rocks in the swift stream above Akaka Falls. One damaged specimen from Akaka Falls, Oct. 24, 1931, F. X. Williams (about water), from the H. S. P. A. collection belongs here. This species is dedicated with pleasure to Dr. F. X. Williams.

**Apulvillus mauiensis** Wirth, new species

A large sub-opaque dark brownish black species, with strong ocellars, weak inner verticals; strong anterior dorsocentrals, one pair of strong acrostichals; costa without long spines; wing more deeply infuscated toward costa; and fourth tarsal segment with long bristles.

♂. Mesofrons shining iridescent black, lateral margins and ocellar tubercle pollinose black; the two pairs of fronto-orbitals, outer verticals, and ocellar bristles strong, the inner verticals very fine and reduced to about half the length of the outer. Face pollinose dark brown, median facial prominence broadly rounding but quite distinct; four pairs of facial bristles in a diagonal row extending ventro-laterad from prominence, the upper pair on the prominence minute, the others progressively larger, with the lateral pair rather strong; facial setulae short and fine; the oral margin fringed by a row of about ten short fine bristles. Cheeks grayish pollinose, with a moderately strong genal bristle and a broad sparse patch of fine setulae behind this to ventro-posterior margin of head. Antennae with third segment about a fourth longer than broad, grayish pubescent; second segment with a small subapical dorsal seta and a ventral apical fringe of setulae; arista stout at base, nearly twice as long as third segment, bare below, with strong pubescence above about three-fourths way to tip.

Mesonotum and scutellum shining black, faintly iridescent violet pollinose; three strong dorsocentrals (1:2); a pair of moderately strong presutural acrostichals (1:0). Mesopleura, pteropleura, and postnotum dark grayish brown pollinose, remainder of pleura gray pollinose; two strong notopleurals, a strong posterior mesopleural and a strong central sternopleural bristle, pleura otherwise bare except for a few scattered minute setulae on mesopleura. Scutellum with the subapical pair of bristles about half as long as the strong apical pair.

Abdomen subopaque dark brownish black with violet iridescence, without segmental banding, the bristle moderate; grayish pollinose below posteriorly. Fifth tergite markedly tapered and rounding pointed apically, about half again as long as fourth, which in turn is longer than third.

Legs subopaque dark brownish black, the coxae, trochanters, and femora grayish pollinose; bristling very much reduced, fore femora practically bare; fourth tarsal segment with a pair of ventral apical bristles half as long as and appressed to fifth segment; tarsal claws long and moderately stout; pulvilli very much reduced to two small pads hardly projecting beyond the bases of the claws; empodium large, nearly as long as the claws.

Wings brownish hyaline with brownish black veins, without markings, but the brownish microtrichiae denser toward costal margin deepening the infuscation there; veins not undulating; costa not thickened between apices of humeral cross-vein and tip of Sc; $R_{2+3}$ and $R_{4+5}$ not more closely approximated at apex; costa distad of tip of $R_1$ with even fringe of short spinules about as long as thickness of costal vein, not interspersed with longer spines. Halteres yellow.

Length—3.3 mm.; wing—3.6 mm.

Holotype ♂, Haipuaena, Maui, June 25, 1920, E. H. Bryan, Jr. Deposited in the B. P. Bishop Museum collection.

Closely related to *Apulvillus williamsi* from which it can be separated by the strong ocellar bristles, strong anterior dorsocentrals, and strong antesutural acrostichals. These characters would link the present species to *Neoscatella oahuense* Williams.

**Apulvillus bronneci** Malloch

*Apulvillus bronneci* Malloch, 1935, B. P. Bishop Mus. Bull. **114**: 198.

Three of Malloch's ♂ paratypes from Uapou, Marquesas Is., which were in the Bishop Museum collection, were examined through the courtesy of Mr. E. C. Zimmerman. The face of one of these is figured in profile (fig. 4, a). The most distinctive features of the insect are as figured by Malloch for the costal thickening of the wing and the distal tarsal segments. In addition the following notes can be added: The face is broad and slanting, and quite similar to that of *cheesmanae;* with the median prominence very faintly indicated, arising well up between the bases of the antennae; there are only two very small lateral facial bristles, and the fringe of bristles on the oral margin is not distinct.

**Apulvillus cheesmanae** (Malloch), new combination

*Chaetoscatella cheesmanae* Malloch, 1935, B. P. Bishop Mus. Bull. **114**: 199.

Three specimens (1 ♂, 2 ♀ ♀) from Faraura Valley, Hitiaa, Tahiti, Society Is., Nov. 17, 1928, A. M. Adamson, coll., from the Bishop Museum collection were examined and compared with Malloch's description. These bear a determination label apparently in Malloch's handwriting. They are clearly closely related to *bronneci,* and are here treated as congeneric, although, when more species of *Apulvillus* may become known, they might readily be segregated into a subgenus *Chaetoscatella* on the basis of the absence of long bristles on the fourth tarsal segment and the presence of long differentiated spines on the costa.

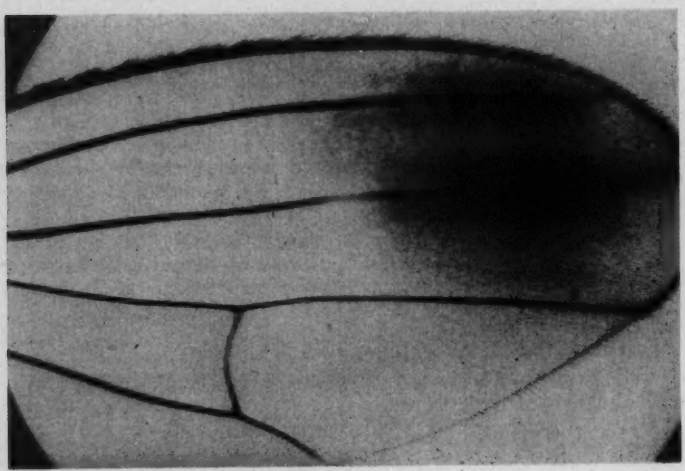

Figure 1. Wing of *Neoscatella kauaiensis.*

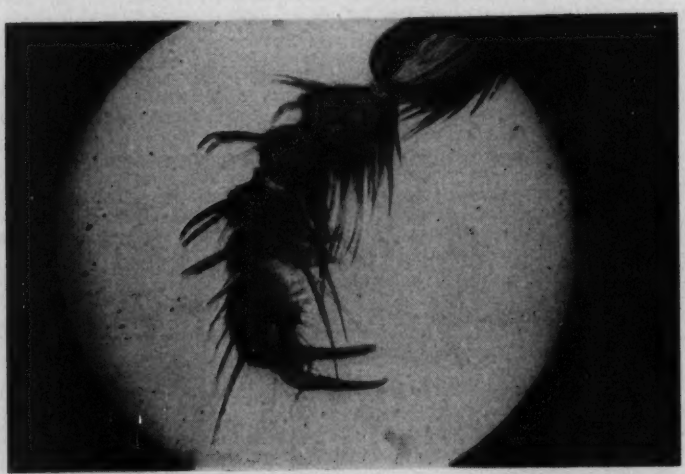

Figure 2. Fore tarsus of ♂ of *Neoscatella clavipes tenda,* enlarged.

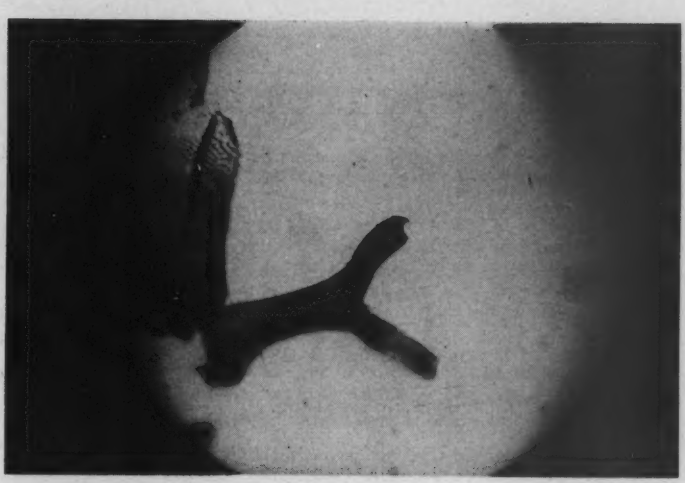

Figure 1. *Apulvillus williamsi*, ♂ clasper.

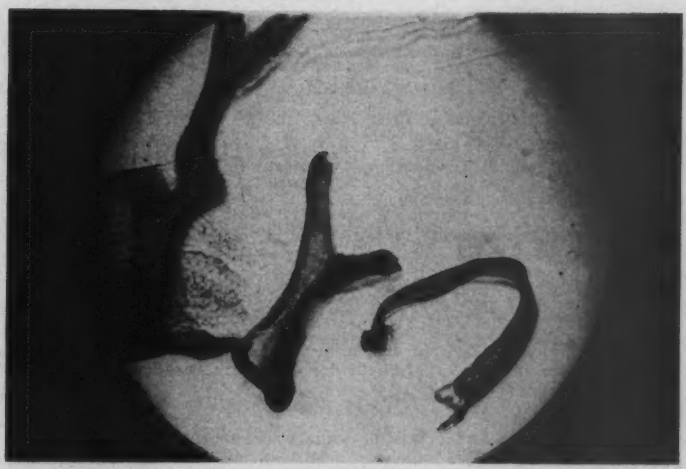

Figure 2. *Neoscatella oahuense*, ♂ clasper and aedeagal apodeme.

## LITERATURE CITED


Cole, F. R.

1927. A study of the terminal abdominal structures of male Diptera (two-winged flies). Proc. Calif. Acad. Sci. **16**: 394-495.

Collin, J. R.

1930. Some new species of the dipterous genus *Scatella* Desv. and the differentiation of *Stictoscatella* gen. nov. (Ephydridae). Ent. Mon. Mag. **66**: 133-139.

Cresson, E. T., Jr.

1926. Descriptions of new species of the dipterous family Ephydridae from Hawaii. Proc. Haw. Ent. Soc. **6**: 275-278.

1935. Descriptions of genera and species of the dipterous family Ephydridae. Trans. Amer. Ent. Soc. **61**: 345-372.

Fullaway, D. T.

1914. A list of Laysan Island insects. Proc. Haw. Ent. Soc. **3**: 20-22.

Grimshaw, P. H.

1901. Diptera. Fauna Hawaiiensis **3**: 1-77.

Jones, B. J.

1906. Catalogue of the Ephydridae, with bibliography and description of new species. Univ. Calif. Publ., Ent. **1**: 153-198.

Malloch, J. R.

1925. Notes on Australian Diptera. Proc. Linn. Soc. N. S. W. **50**: 329.

1934. Ephydridae, Sphaeroceridae, and Milichiidae. Ins. of Samoa, part 6, fasc. 8., pp. 267-328.

1935a. Some acalyptrate Diptera from the Marquesas Islands. B. P. Bishop Mus. Bull. **114**: 3-31.

1935b. Additional new species and other records of acalyptrate Diptera (Sapromyzidae, Asteiidae, Drosophilidae, Ephydridae, and Trypetidae) from the Marquesas Islands. B. P. Bishop Mus. Bull. **114**: 179-200.

Osborn, H. T.

1915. Entomological note. Proc. Haw. Ent. Soc. **3**: 90, 112.

Tonnoir, A. L., and Malloch, J. R.

1926. New Zealand Muscidae and Acalyptratae. Rec. Canterbury Mus. **3**: 1-26.

Usinger, R. L.

1941. Problems of insect speciation in the Hawaiian Islands. Amer. Nat. **75**: 251-263.

Warren, A.

1914. Notes on a new ephydrid fly. Proc. Haw. Ent. Soc. **3**: 25.

Williams, F. X.

1938. Biological studies in Hawaiian water-loving insects. Part III. Diptera or flies. A. Ephydridae and Anthomyiidae. Proc. Haw. Ent. Soc. **10**: 85-119.

Zimmerman, E. C.

1942. Distribution and origin of some eastern oceanic insects. Amer. Nat. **76**: 280-307.

# Notes on Marianas Islands Curculionidae (Coleoptera)

By ELWOOD C. ZIMMERMAN
Hawaiian Sugar Planters' Association Experiment Station

*(Presented at the meeting of December 8, 1947)*

This is a report based principally upon the weevils collected by R. G. Oakley and Henry Townes in the Marianas Islands in 1946 during the entomological survey under the direction of the United States Commercial Company. The material was sent to me for study by the Division of Insects, United States National Museum. I have added some notes from other specimens from the collections of the Hawaiian Sugar Planters' Association Experiment Station and Bishop Museum.

Perhaps the most outstanding contribution made by this collection is that it reveals for the first time that many of the species heretofore known only from Guam are more widespread in the archipelago.

## Subfamily OTIORHYNCHINAE

**Trigonops inusitata** Zimmerman.

*Trigonops inusitata* Zimmerman, Bishop Mus. Bull. 172: 83, pl. 1, F, 1942.

Rota Island: eight examples taken on leaves of *Pipturus argenteus* at Rugi, June 29, 1946, Oakley number 930. This is a new island record, for the species has been known only from the type island of Guam. The average color of the scaling on this series is paler than for the Guam specimens, and possibly it may be associated with the color of the hostplant.

**Trigonops inaequalis** Zimmerman.

*Trigonops inaequalis* Zimmerman, Bishop Mus. Bull. 172: 84, pl. 1, E, H, 1942.

Tinian Island: two specimens taken on *Morinda citrifolia* leaves on Mt. Lasso, June 12, 1946, Townes number 647.

This species has been known only from Guam. The dorsal color and color pattern of the scales is subject to striking variation, and different individuals of a series frequently may be thought not to be this species.

**Trigonops hirsuta** Zimmerman.

*Trigonops hirsuta* Zimmerman, Bishop Mus. Bull. 172: 87, pl. 1, D, 1942.

Agrihan: two examples collected August 12, 1945, by D. J. Borror. Guam: three specimens Agaña airport, taken on screens of airport building, Townes number 658, June 13, 1946.

Rota: ninety examples collected on sweet potato leaves at Ongiano, June 27, 1946, Oakley number 911. Seven specimens taken on *Intsia bijuga*, June 29, 1946, at Rugi, Oakley number 981. Nine specimens from eggplant from Rota village, June 20, 1946, Townes number 863.

Tinian: twenty-one specimens from cotton leaves in Marpo Valley, June 11, 1946, Oakley number 570; four, same place and date from grape vines, Oakley number 588; four, same place and date on guava, Oakley number 571. Three examples from leaves of *Morinda citrifolia* at Mt. Lasso, June 12, 1946, Townes number 647, and eight examples from leaves of *Bikkia marianensis*, June 11, 1946, Townes number 632, and without locality other than Tinian.

The records from Rota, Tinian and Agrihan are new; the species has been recorded only from Guam.

There is a bewildering variation in color and pattern in these large series. The dorsal scaling varies from white to brown.

**Trigonops viridis,** new species (figure 1).

Derm mostly shining black, but with antennae, coxae, bases of femora, parts of tibiae and tarsi, and last two or three ventrites reddish brown; scaling predominantly green over-all, but some examples with the green faded or gray with a faint greenish, purplish or bronze cast, the scales iridescent; without a dorsal color pattern other than a variable, paler, median vitta on pronotum and a paler suture on elytra.

*Head* with front punctured, but punctures not very prominent, mostly inconspicuous because of the placement of the scales, bearing white decumbent setae which are conspicuous only at inner margins of eyes; scales round or ovate, usually appearing slightly convex and hard, mostly appearing scattered and each separated distinctly from its neighbor so that derm is plainly visible, with a small bare patch at angle of basal rostral suture; eyes evenly convex, strongly interrupting longitudinal lateral outline of head, about four-fifths to nearly as long as narrowest part of interocular area.

*Rostrum* with basal part between transrostral carina and basal suture nearly straight or appearing slightly concave as seen in profile, slightly shorter than interocular breadth, median line partly bare; declivitous apical part shiny, the round punctures capped with round scales or giving rise to white setae.

*Antennae* with scape about as long as funicle plus first segment of club, closely squamose but with scattered bare patches surrounding the origins of the numerous, long, decumbent setae, expanded distad; funicle with short and long setae and no scales, lengths of segments as follows: (1, 19, to base in apical sinus of scape) (2, 19) (3, 12) (4, 12) (5, 10) (6, 10) (7, 10); club as long as three preceding segments, its first segment as long as seventh funicular segment, two-tenths longer than its second segment.

*Prothorax* as broad as long (but appearing longer), broadest at middle, almost evenly arcuate on sides (measurements of one example [20 units to 1 mm.]: breadth at extreme base, 38; breadth at middle, 44; breadth at apex, 33; length, 44), gently and nearly evenly arcuate in longitudinal dorsal out-

line; punctures, although numerous, not individually conspicuous but obscured by the numerous, small, low, rounded, shiny granules protruding between the scales; scales not imbricated and with derm showing between many of them, especially on disc, rounded, mostly appearing slightly convex; setae inconspicuous, short, decumbent, not rising above the surface, none, or only a few at apex, to be seen on median line in profile.

*Elytra* two-thirds to seven-tenths as broad as long, females broadest at about basal third; base subtruncate or shallowly concave; scales rounded, appressed, mostly appearing flatter than those on pronotal disc, dense but not imbricated except laterad and caudad, most scales on disc slightly separated from or just touching their neighbors; striae marked by series of bare black spots where a low, shiny granule precedes each strial puncture, each puncture with a small, inconspicuous, recumbent seta, not impressed between punctures; intervals each bearing a row of small, decumbent setae which may be overlooked easily on disc.

*Legs* with hind femora reaching to a point below apex of first elytral stria in male (nearly to elytral apex), and to a point below and between apices of second and third striae in female, one-tenth longer than hind tibia, as wide at base as middle of tibia, strongly clavate, widest part of bulbous part at about three-fifths length of femur from base and there not quite three times as broad as base of femur; squamae on all femora densest on the expanded part and distad, nearly naked basad and ventrad, with numerous, slightly curved, slanting setae; tibiae squamose and with longer, more erect setae than femora.

*Sternum* with pleura of mesosternum broadly bare and shiny just above coxa, thence densely squamose to elytra, but epimeron usually with few scales; metasternum at its narrowest point between meso-and metacoxae as long as breadth of a mesocoxa.

*Venter* with first two ventrites nearly or quite free from squamae broadly down middle, but squamose as elytra on sides, shallowly depressed down middle in male, less distinctly so in female, punctures shallow, bearing white, slanting setae; ventrites three, four and five not squamose, third and fourth with fine setae confined mostly or entirely to sides and not punctuate on discs, fifth roughened over-all by setiferous punctures and about one-fourth longer than three plus four along median line. Length (excluding head and rostrum): 5-7 mm.; breadth: 2.5-3.5 mm.

Rota Island: Holotype male (U. S. National Museum number 58711), allotype female, and 16 paratypes collected from leaves of *Guettarda speciosa* at Rota Village, June 20, 1946, Townes number 803; eight paratypes collected on *Intsia bijuga* at Rugi Village, June 26, 1946, Oakley number 931; and two abraded specimens from the Bishop Museum collection collected by H. Hornbostel on Rota, July 15, 1925.

In my key to the Guam *Trigonops* (1942), this species runs to couplet 7(6) which includes *vulgaris* and *convexa*—two very different-appearing species. The larger size and different coloring of this species easily distinguishes it, and it should not be confused with any other known species from the Marianas.

**Trigonops angulithorax,** new species (figure 1).

Derm reddish brown to black, elytra, pronotum, front of head, rostrum, clavae of femora, two basal abdominal segments black or nearly so, otherwise reddish brown to piceous with variation in the two available specimens;

scaling on holotype mostly pearl-gray, on allotype mostly bluish green, nearly concolorous and without a pattern; scales iridescent.

*Head* with frontal punctures distinct, each bearing a distinct, fine, white, decumbent seta; scales numerous, rather evenly placed, but not dense, much of derm exposed between them, round or oval, appearing hard, mostly slightly convex and mostly each distinctly separated from its neighbor and with a bare median patch at angle of basal rostral suture; eyes strongly convex, about three-fourths as broad as long as seen from front, strongly protuberant, posterior contour steeper than anterior contour in male holotype, nearly evenly convex in female allotype, length of eye compared to breadth of interocular area in holotype male 12/14, in allotype female 13/18.

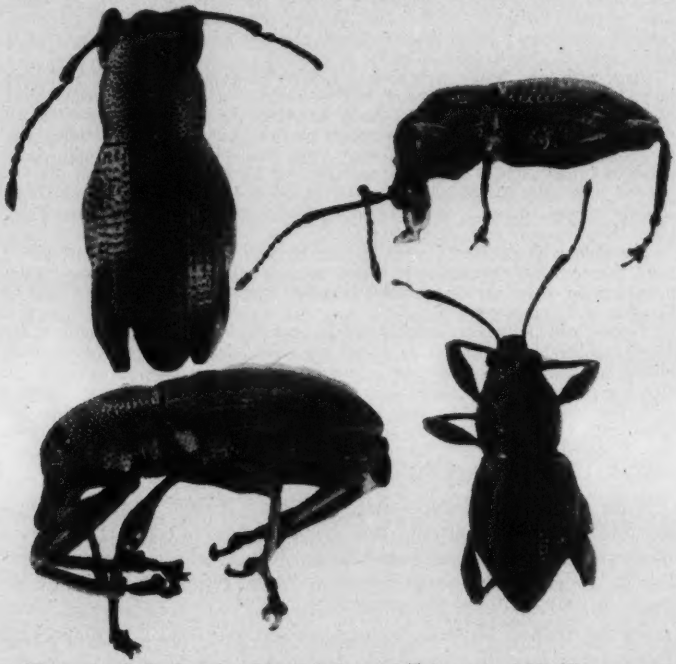

Figure 1.—Left, dorsal and lateral views of *Trigonops viridis* Zimmerman, paratype male; right, the same of the holotype male of *Trigonops angulithorax* Zimmerman. (Photographs by J. T. Yamamoto.)

*Rostrum,* as seen in profile, with area between basal suture and transrostral carina nearly straight, about as long as interocular breadth in holotype male, distinctly shorter in allotype female; scaling similar to that on head.

*Antennae* (on holotype) with scape as long as funicle plus about three-fourths of club, gradually expanded, scales numerous but not dense, the long decumbent setae dark on fore (upper) side, white on hind (lower) side; funicle with short and long setae but no scales, lengths of segments as follows: (1, 9, to base of apical sinus of scape) (2, 7.5) (3, 6) (4, 5) (5, 5) (6, 4)

(7, 4.5); club as long as preceding three and one-half funicular segments, its first segment subequal in length to its second segment and to seventh funicular segment.

*Prothorax* slightly transverse, broadest just behind middle, nearly evenly arcuate on sides; measurements of holotype (20 units equal 1 mm.): breadth at extreme base, 30; breadth at widest part, 33; breadth at apex, 24; length, 30; longitudinal dorsal contour as seen from side on about same plane as basal part of elytra to about middle, thence sloping at an angle of nearly 45 degrees to apex, the subapical constriction passing through the declivitous part and making it concave; closely punctuate, inter-puncture areas giving a subgranulate appearance to disc; scales rounded, slightly convex, appearing hard, not imbricated, much of derm exposed, more widely spaced laterad; setae distinct, decumbent, not rising above surface, none to be seen rising above median line in profile.

*Elytra* two-thirds as broad as long and twice as long as prothorax in holotype male, about five-eighths as broad as long and two and two-thirds times as long as prothorax in allotype female; base subtruncate; broadest at about middle; scales rounded, appressed, mostly appearing flatter than those on pronotal disc, not imbricated, mostly narrowly separated; striae at most broadly, shallowly, rather indefinitely impressed between punctures, punctures each bearing a small, recumbent seta; intervals each with a row of similar setae.

*Legs* with hind femora reaching to apex of fifth ventrite in male, to slightly beyond apex of fourth ventrite in female, about one-tenth longer than hind tibia, narrower at base than middle of hind tibia, strongly clavate, widest part of clava at a little more than three-fifths distance from base to apex and three times as broad as base of femur, comparatively thinly clothed with scales, densest along dorsal edge, least dense on under sides of clavae and naked basad; tibiae thinly squamose and with setae straighter and more erect than those of femora.

*Sternum* sparsely squamose, pleura of mesosternum with scattered scales; metasternum at its narrowest point between mid-and hind coxae about as broad as breadth of a mesocoxa in allotype female, distinctly narrower in holotype male.

*Venter* sparsely squamose at sides of first two ventrites and with a few scattered scales on apical part of second ventrite only; second ventrite more sharply depressed on disc than in female; punctures on first two segments mostly small and shallow, bearing rather long, slanting, slender, white setae; ventrites three and four with at most a single row of rather obscure setiferous punctures at middle, numerous only at sides; ventrite five roughened by numerous setiferous punctures, slightly longer than three plus four, 2.2 broader than long in holotype male, 1.4 broader than long in female allotype.

Length (excluding head and rostrum): 5-6 mm.; breadth: 2.1-2.6 mm.

Saipan Island: Holotype male (U. S. National Museum number 58712), swept from *Aglaia* at Kannat e Edtot, June 27, 1946, Townes number 875; allotype female, in Bishop Museum, Honolulu, collected on Saipan on September 3, 1944, by D. G. Hall and without additional data.

This is the only known Mariana *Trigonops* which has a strongly convex, angulate dorsal pronotal contour, and this character alone will serve to separate it from all others. My key to the species of Guam *Trigonops* (1942) may be altered to receive this species as follows: change the 3 in dichotomy 2 to 2a and insert the following:

2a (2). Pronotum, as viewed from side, strongly convex and with apical part sloping downward at a conspicuous angle from basal part.....**angulithorax** Zimmerman.
Longitudinal dorsal contour of pronotum gently convex ..... 3

The allotype is a rubbed specimen. The elytral suture of the holotype is narrowly bare basad to form a narrow, acuminate, bare line.

## Subfamily APIONINAE

**Cylas formicarius** (Fabricius).

*Brentus formicarius* Fabricius, Ent. Syst., Suppl., p. 74, 1798. Zimmerman, Bishop Mus. Bull. **172**: 93, pl. 6, D, 1942.

Rota: seven specimens from sweet potato vines and tubers taken at Son Son, June 26, 1946, Oakley number 788.

Saipan: five specimens from sweet potato, June 18, Oakley number 716; twelve examples from vines and tubers of sweet potato, Marpo Valley, June 11, 1946, Oakley number 554.

## Subfamily ANTHONOMINAE

**Usingerius maculatus** Zimmerman.

*Usingerius maculatus* Zimmerman, Bishop Mus. Bull. **172**: 94, pl. 6, A, B, 1942.

Tinian: 33 examples from *Cynometra* foliage on Mt. Lasso, June 9, 1946, Townes number 619; 47 specimens from *Cynometra* (*bijugans?*) in Marpo Valley, June 10, 1946, Oakley number 534.

Saipan: one specimen from Kannat e Edtot, June 27, 1946, Townes number 885.

This weevil heretofore has been known only from Guam. The color pattern is variable.

## Subfamily CRYPTORHYNCHINAE

**Deretiosus ficae** Zimmerman.

*Deretiosus ficae* Zimmerman, Bishop Mus. Bull. **172**: 102, pl. 3, A, 1942.

Tinian: one example from Mt. Lasso, June 16, 1946, collected by F. C. Hadden is the first example of this species to be recorded outside of Guam.

**Camptorhinus dorsalis** (Boisduval).

*Cryptorhynchus dorsalis* Boisduval, Voy. Astrolabe 2:434, 1835. Zimmerman, Bishop Mus. Bull. **172**: 103, pl. 2, B, 1942.

Guam: one example taken at Agaña Airport, June 13, 1946, Townes number 658.

Tinian: two specimens from Mt. Lasso, June 16, 1946, F. C. Hadden. This is a new island record.

**Menectetorus setulosus** (Boheman).

*Cryptorhynchus setulosus* Boheman, Eugenies Resa, Coleoptera, p. 140, 1859.

*Menectetorus setulosus* (Boheman) Zimmerman, Bishop Mus. Bull. 172: 106, pl. 3, B, 1942.

Tinian: one example from Mt. Lasso, June 12, 1946, from leaves of *Melanolepis multiglandulosa*, Townes number 644. One example from same place taken by F. C. Hadden, June 16, 1946.

This species has been recorded heretofore only from Guam.

**Menectetorus simplex,** new species (figure 2).

Derm reddish brown to piceous; color pattern of scales as follows: head with a pale median vitta, pale above each eye and nearly or quite black between these white areas, the dark scaling may tend to form a vague V on crown; rostral scaling mixed, but mostly pale; prothorax mostly pale on sides, but with variable brown patches, pale scaling extending dorsad onto sides of pronotum and extending inward to a point opposite fourth elytral interval, disc of pronotum either almost entirely black or black with brown maculations, prescutellar point pale; elytra confusedly marked with black and pale brown, humeri nearly white, setae mixed black, pale brown and white; scutellum white; ventral surfaces with mostly pale brown and white scales; legs with femora with pale scales but with a broad median black band and a dark apical or subapical band, tibiae broadly black at base, otherwise pale.

*Head* with derm concealed by dense scaling, interocular area with numerous, slanting, rather narrowly subspatulate setae which extend onto base of rostrum, these setae not confined to ocular margins and obscure on crown.

*Rostrum* squamose to within apical third in male, only in about basal fourth in female; setose to apex in both sexes; vaguely tricarinate above insertions of antennae in male, shiny and with numerous punctures in female.

*Antennae* with scape as long as first four funicular segments; first funicular segment as long as two plus three, two as long as three plus four plus about one-half of five, three to seven subequal, seven broadest; club about equal in length to preceding five funicular segments.

*Prothorax* about as long as broad, at most slightly transverse; base strongly bisinuate; sides arcuate from base to subapical constriction; disc with four shallow depressions: two on median line, one of these near base, the other at edge of subapical constriction (this usually less developed or obsolete), and one on either side of median line at middle and centered on a line drawn from each second elytral stria; scaling more appressed than spongy; setae curved, erect, rather narrowly subspatulate.

*Elytra* about seven-twelfths as broad as long, about two and one-half times as long as prothorax, subparallel-sided to subapical constrictions; intervals all broader than striae, each with a row of conspicuous, slanting-erect, narrowly spatulate setae, one and two not so convex on disc as three, none of the intervals elevated; striae well marked, setae in their punctures obscure; elytra without elevations, irregularities or fascicles.

*Legs* with tibiae each with a small, slender denticle at apex of dorsal edge at base of line of short bristles along axis of uncus.

*Sternum* with metasternum densely set with mostly imbricated scales and with rather numerous setiferous punctures, the shortest distance between mid and hind coxae about one-fourth more than breadth of a mesocoxa.

*Venter* with dense round or ovate scales mostly slightly imbricated, less dense in middle; first ventrite slightly longer than length of metasternum between mid and hind coxae and as long as ventrite two plus half of three; ventrite two as long as three plus four which together are as long as five; setae, except on last ventrite, mostly appressed, narrow, elongate.

Length: 3-3.25 mm.; breadth: 1.6-1.75 mm.

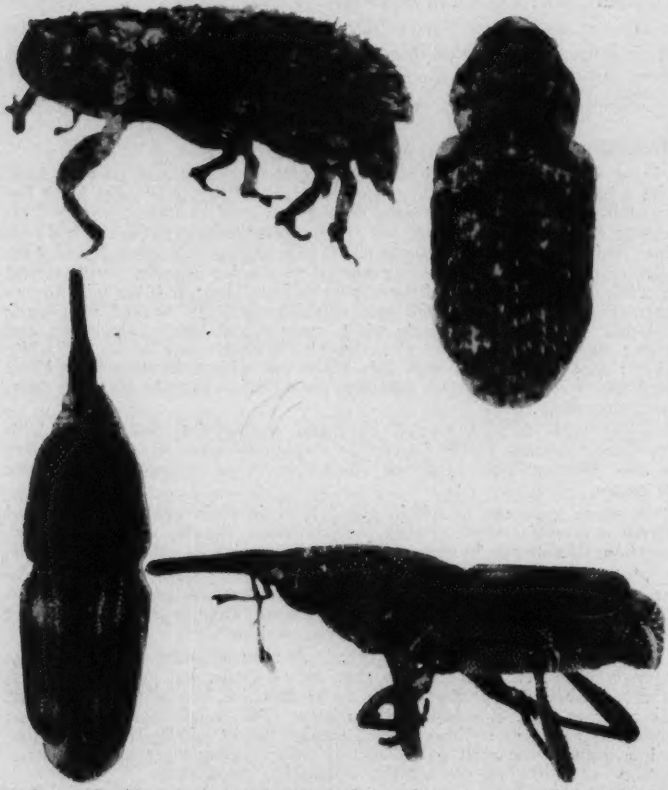

Figure 2.—Top, lateral and dorsal views of paratype female of *Menectetorus simplex* Zimmerman; bottom, the same of *Myocalandra exarata* (Boheman). (Photographs by J. T. Yamamoto.)

Guam. Holotype male (U. S. National Museum number 58713), allotype female, and one female paratype. The holotype and allotype bear the label "R. G. Oakley, Guam '37", the paratype contains

the following additional information: "Ripe papaya, Malolos, December 27, 1937".

This species may be separated easily from the only other known species of the genus known from the Marianas because of its comparatively plane pronotum on which the foveae are very shallow as compared to *setulosus,* by its not having elevated elytral intervals as does *setulosus,* as well as other characters. It is a more obscurely colored species than is *setulosus,* and the elytra may appear to be vaguely tesselated.

**Anaballus amplicollis** (Fairmaire).

*Acalles amplicollis* Fairmaire, Rev. Mag. Zool. 2, 1:36, 514, 1849. Zimmerman, Bishop Mus. Bull. **172**: 109, pl. 2, A, 1942.

Rota: 12 specimens taken at Rugi, June 27, 1946; they are labeled Oakley 909, in sweet potato.

This is a new locality record for this species which is widespread in the Pacific, and to my knowledge this is the first record of its attacking sweet potato.

**Euscepes postfasciatus** (Fairmaire).

*Cryptorhynchus postfasciatus* Fairmaire, Rev. Mag. Zool. 2, 1: 513, 1849. Zimmerman, Bishop Mus. Bull. **172**: 109, pl. 2, C, 1942.

Rota: seven specimens from sweet potato tubers, June 26, 1946, Oakley number 792.

This is a new island record for the pest.

**Daealus tuberosus** Zimmerman.

*Daealus tuberosus* Zimmerman, Bishop Mus. Bull. **172**: 111, pl. 2, D, 1942.

Guam: two examples from Agaña Airport, June 13, 1946, Townes number 658.

Rota: Rugi Village, 39 examples "in sweet potato," June 27, 1946, Oakley number 909, and 9 examples from sweet potato vine on same date, Oakley number 910.

The variation in size and color in this species may cause confusion. The large series of fresh examples from sweet potato are rather uniform in size and are conspicuously brown in ground color, with the dark patches contrasting sharply. Before examining the series carefully, I thought that it possibly represented a new species. Some of the specimens from sweet potato vines are old and have very pale scaling.

This species has been known heretofore only from Guam. The sweet potato host record is new and should be investigated in detail. According to Oakley, adults and larvae were abundant in

the vines and tubers in one field, but it was not found in any other plot.

**Daealus tibialis** Zimmerman.

*Daealus tibialis* Zimmerman, Bishop Mus. Bull. **172**: 113, pl. 2, E, 1942.

Guam: 14 examples taken at Talofofo on *Morinda citrifolia*, June 16, 1946, Townes number 661.

Rota: two examples taken at Rota Village on the same host, June 20, 1946, Townes number 802.

This species has been known only from Guam.

**Microcryptorhynchus guamae** Zimmerman.

*Microcryptorhynchus guamae* Zimmerman, Bishop Mus. Bull. **172**: 115, pl. 3, E, 1942.

Tinian: three examples taken on *Anona muricata* foliage at Lake Hagoya, June 10, 1946, Townes number 622.

Saipan: three specimens taken by Townes at Kannat e Edtot, June 27, 1946, two of these swept from *Aglaia* (number 875), the other swept from *Acacia confusa* (number 876).

These locality and host records are new. The species has been known from the type series from Guam where it was collected from *Cestrum* and *Premna*.

## Subfamily COSSONINAE

**Cylindrotrypetes suffusus** Zimmerman.

*Cylindrotrypetes suffusus* Zimmerman, Bishop Mus. Bull. **172**: 119, pl. 4, H, 1942.

Rota: 13 specimens taken on *Pandanus tectorius*, near Sabana, June 23, 1946, Townes number 837.

This species has been known only from Guam.

**Phloeophagosoma sulcirostre** Zimmerman.

*Phloeophagosoma sulcirostre* Zimmerman, Bishop Mus. Bull. **172**: 142, pl. 5, E, 1942.

An example bearing the identical field data as the holotype of this species has been sent to me with the Townes-Oakley collection. It is darker in color than the holotype, and it indicates that the holotype is teneral.

**Pholidoforus setolineatus** Zimmerman.

*Pholidoforus setolineatus* Zimmerman, Proc. Hawaiian Ent. Soc. **11**(3): 342, fig. 1, c, f, h, 1943.

Guam: one rubbed example was collected from decaying wood at the Root Agricultural Farm, October 11, 1937, by Oakley. This

is the second known specimen to be recorded. I collected the holotype on Tutuila, Samoa. Perhaps the species has been carried by man to a number of Pacific islands.

## Subfamily RHYNCHOPHORINAE

**Rhabdoscelus obscurus** (Boisduval).

*Calandra obscura* Boisduval, Voyage de l'Astrolabe, Ent. 2 : 448, 1835. Zimmerman, Bishop Mus. Bull. **172** : 144, pl. 7, A, 1942.

Tinian: one example from Mt. Lasso, on sugar cane, June 10, 1946, Oakley number 595.

This is a widespread pest of sugar cane.

**Cosmopolites sordidus** (Germar).

*Calandra sordida* Germar, Ins. Spec. Nov. p. 299, 1824. Zimmerman, Bishop Mus. Bull. **172** : 144, pl. 6, G, 1942.

Saipan: five examples were taken from banana roots, June 18, 1946, Oakley number 713.

This banana pest is known elsewhere in the Marianas from Guam, but it is probable that it is widespread in the archipelago. The predaceous histerid beetle *Plaesius javanus* Erichson has been introduced recently (1947) from Fiji to Guam to aid in the control of the beetle. When the histerid becomes established on Guam it will be worthwhile to forward colonies to the other Marianas Islands where the weevil is a pest.

**Polytus mellerborgi** (Boheman).

*Sitophilus mellerborgi* Boheman, in Schoenherr's Gen. Spec. Curc. **4**(2) : 976, 1838. Zimmerman, Bishop Mus. Bull. **172** : 144, pl. 6, I, 1942.

Saipan: two examples were taken from banana roots on June 18, 1946, Oakley number 714. This is a new island record.

**Myocalandra exarata** (Boheman) (figure 2).

*Sitophilus exaratus* Boheman, in Schoenherr's Genera et Species Curculionidum **4**(2) : 970, 1838.

*Calandra porcata* Pascoe, Ann. Mus. Civico Genova **2**, 2 : 306, 1885.

*Myocalandra discors* Faust, Ann. Mus. Civico Genova 34 : 355, 1894.

Saipan: a series of specimens was collected by W. H. Lange damaging bamboo, October 15, 1947. This is a widespread species known from Madagascar, Mauritius, Seychelles, India, Malay Peninsula, Malay Archipelago, Philippines and New Caledonia.

## NEW INSECT RECORDS FOR THE YEAR 1947

Species marked with an asterisk were reported in the Hawaiian Islands for the first time in 1947, on the dates recorded in the text. Those not so marked were observed here prior to that year, but have only now been identified or recorded. For particulars refer to the pages indicated.

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VOL. XIII, No. 3 MARCH, 1949

PROCEEDINGS

OF THE

# HAWAIIAN ENTOMOLOGICAL SOCIETY

FOR THE YEAR 1948

HONOLULU, HAWAII

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PROCEEDINGS

OF THE

# Hawaiian Entomological Society

VOL. XIII, NO. 3 FOR THE YEAR 1948 MARCH, 1949

## JANUARY 12, 1948

The 505th meeting was held at the H.S.P.A. Experiment Station on Monday, January 12, at 2:00 p.m., with President Fullaway in the chair.

*Members present:* Balock, Bianchi, Bonnet, Fullaway, Holdaway, Keck, Krauss, Lewis, Look, Mainland, Pemberton, Ritchie, Rosa, Sakimura, Swezey, Tanada, Tuthill, Van Zwaluwenburg, Weber and Zimmerman.

### NOTES AND EXHIBITIONS

*Erebus odora* (L.)—Mr. Krauss reported that a specimen of this agrotid moth, the black witch, was collected at Haiku, Maui on August 4, 1929; this is the first record for that island. The moth was first found in the Islands at Honaunau, Kona, Hawaii by A. C. Mason, October 15, 1928. Other first records are: Oahu, November 7, 1928; Kauai, January 27, 1929, and Molokai, April or early May, 1929. There are no published records of this species for Lanai or Niihau. The late Bro. Matthias Newell once said he had observed what was probably this moth at Hilo, Hawaii, some years prior to 1928.

*Opsius stactogallus* (Amyot)—Mr. Krauss exhibited this cicadellid leafhopper taken on tamarix at Keomuku, Lanai, October 28, 1947, and on the same host near Paia, Maui, November 12. These are both new island records. The species was first taken in the Islands on Oahu in June or July, 1928, and was later found on Molokai (1943) and Kauai (1944).

*Stragania robusta* (Uhler)—Mr. Krauss exhibited specimens of this North American cicadellid (determined by Dr. Swezey) taken at La Perouse Bay, Maui, November 11, and at Waihee, Maui, November 12; this is a new island record. This insect, formerly known as *Bythoscopus robustus*, had earlier been found at Kawela Bay, Oahu, April 23, 1933, and on Molokai, June 4, 1943.

*Opius* bred from *Eutreta*—Mr. Fullaway reported breeding the braconid *Opius tryoni* Cameron from galls of the lantana tephritid fly, *Eutreta xanthochaeta* Aldrich. He added that Q. C. Chock in the Philippines, bred an undetermined species of *Opius* from hau buds (*Hibiscus tiliaceus*) infested by tephritids of the genus *Acidoxantha*.

New species of Hawaiian *Clunio*—Mr. Van Zwaluwenburg called attention to a paper by Alan Stone and W. W. Wirth (Proc. Ent. Soc. of Washington, 49: 201-224, 1947) in which are described three new tendipedid flies from Hawaii: *Clunio littoralis, C. vagans* and *C. brevis.*

*Dacus dorsalis* Hendel—Dr. Ritchie reported the presence of this fruitfly on Guam. K. L. Maehler bred it December 19, from bananas grown near Agaña.

*Scolia ruficornis* Fabr.—Mr. Pemberton exhibited specimens of this scoliid. He said that this wasp is being introduced from Zanzibar to the Palau Islands to control the coconut beetle, *Oryctes rhinoceros* (L.), under direction of the Pacific Science Board, National Research Council, at the request of the Navy. Living material is being shipped by Harold Compere via New York to Honolulu, where the wasps are fed and sent on through Guam to the Palaus. Of four consignments made during November and December, 1947, two arrived here with all material dead. A fair number of wasps were alive in the other two lots. *Oryctes rhinoceros* causes great damage to coconut trees in the Palaus. In Zanzibar *S. ruficornis* is reported to parasitize the larvae of *Oryctes monoceros* Olivier and of *O. boas* Fabr.

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## FEBRUARY 9, 1948

The 506th meeting was held at the H.S.P.A. Experiment Station on Monday, February 9, at 2:00 p.m., with Vice-President Balock in the chair.

*Members present:* Alicata, Balock, Bianchi, Bonnet, Joyce, Kartman, Keck, Krauss, Lewis, Mainland, Nishida, Pemberton, Ritchie, Rosa, Stout, Swezey, Tanada, Tuthill, Van Zwaluwenburg, Weber and Zimmerman.

*Visitors:* Miss Constance Inada, Mr. John H. Fales.

It was unanimously voted to confer on Dr. Francis X. Williams honorary membership in token of his long service to the Society. Miss Constance Inada was nominated for membership.

### NOTES AND EXHIBITIONS

*Dacus dorsalis* Hendel—Mr. Van Zwaluwenburg said that this fruitfly, though known from Kauai since the latter part of 1946, has until now never been reported from that island. The distribution records for this species in Hawaii now include the islands of Niihau, Kauai, Oahu, Lanai, Molokai, Maui, Kahoolawe[1] and Hawaii.

Mr. Look reported breeding *D. dorsalis* from persimmon fruits (*Diospyros kaki*) collected December 11 at Mountain View, Hawaii; this is a new host record.

New immigrant *Volucella*—Mr. Van Zwaluwenburg called attention to descriptions by Curran of two new syrphid flies recently

[1] Reported in December 1948, by E. C. Zimmerman.

found on Oahu, and obviously immigrants from America (Amer. Mus. Novitates, no. **1361,** Nov. 3, 1947); *Volucella dracaena,* first taken by Charles Hoyt, January 1, 1946 (Proc. Haw. Ent. Soc., **13**: 4, 6, 1947) on flowers of *Dracaena* and of *Hoya* in Honolulu; and *Volucella hoya,* first collected by Dr. Williams, March 3, 1946, on *Hoya* flowers in Honolulu. Among the type material of *V. hoya,* Dr. Curran records specimens from Oahu and Lower California; *V. dracaena* so far is known only from Honolulu. Mr. Pemberton said he had recently bred *V. hoya* from rotting breadfruit.

*New thrips records*—Mr. Look reported new host records for two species of thrips determined by Mr. Sakimura, from the island of Hawaii. *Heliothrips haemorrhoidalis* (Bouché) on taro leaves at Ahualoa; and *Isoneurothrips carteri* Moulton, on naio leaves (*Myoporum sandwicense*) on Mauna Kea at 4,000 ft. elevation. This latter species was breeding within old tunnels of a leafminer, and was associated with *Haplothrips rosai* Bianchi and the eulophid, *Thripoctenus brui* Vuillet.

Mr. Krauss reported new island records from thrips collected by him on Lanai (October-November, 1947); Molokai (November 3-5); and Maui (November 7-15). Identifications were by Mr. Sakimura.

**Lanai**

*Chirothrips mexicanus* Crawford (Lanai City)
*Anaphothrips swezeyi* Moulton (Lanai City)
*Hercothrips fasciatus* (Pergande) (west coast of the island)
*Frankliniella minuta* (Moulton) (mountains)
*Frankliniella sulphurea* Schmutz (Lanai City)
*Isoneurothrips antennatus* Moulton (mountains)
*Plesiothrips panicus* (Moulton) (Lanai City)
*Hoplothrips flavitibia* Moulton (Maunalei gulch, and in the mountains)

**Molokai**

*Hoplothrips flavitibia* Moulton (Halawa Valley and Mapulehu)

**Maui**

*Organothrips bianchii* Hood (Waihee)
*Docidothrips trespinus* (Moulton) (Huelo)
*Taeniothrips cyperaceae* Bianchi (Kihei)
*Karnyothrips melaleuca* (Bagnall) (Pauwela)
*Haplothrips fusca* Moulton (Kihei)
*Haplothrips sesuvii* Priesner (Kihei)

Insects on *Opuntia*—Mr. Krauss exhibited a collection of insects, identified by Mr. Pemberton, collected January 22 at Keawanui, Molokai on a cactus, *Opuntia megacantha,* attacked by *Fusarium* disease:

*Dactylosternum dispar* Sharp (a new island record)
Numerous larvae of a syrphid, probably *Volucella pusilla* (Macquart), many of which were flying about
*Copris incertus prociduus* Say (one specimen)
*Belonuchus ophippiatus* (Say) (two specimens) (a new island record for this staphylinid)

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## MARCH 8, 1948

The 507th meeting was held at the H.S.P.A. Experiment Station on Monday, March 8, at 2:00 p.m., with Vice-President Balock in the chair.

*Members present:* Balock, Beller, Bianchi, Joyce, Keck, Krauss, Lewis, Mainland, Nishida, Pemberton, Ritchie, Rosa, Sakimura, Stout, Swezey, Tuthill, Van Zwaluwenburg, Weber and Zimmerman.

*Visitor:* John H. Fales.

Miss Constance Inada was elected to active membership, and Miss Mabel Chong was nominated for membership.

### NOTES AND EXHIBITIONS

*Latrodectus geometricus* Koch—Mr. Pemberton said that he had recently observed a female of the false black widow spider feeding on a freshly killed female of the house spider, *Heteropoda regia* (Fabr.). This was at the edge of the *Latrodectus* nest which contained two egg-sacs filled with unhatched eggs. The *Heteropoda* was carrying an egg sac in which were a number of newly hatched young. A few feet away from this nest Mr. Bianchi observed another *geometricus* nest in which was a well-grown, freshly killed scorpion, *Isometrus maculatus* DeGeer.

*Dacus dorsalis* Hendel—Mr. Weber gave the following list of previously unrecorded hosts of the oriental fruitfly, reared from field-collected fruits by Miss Chong, and all from Oahu with the exception of *Dovyalis* which was from Maui:

| | |
|---|---|
| **Averrhoa carambola** | Carambola |
| **Bumelia rotundifolia** | |
| **Capsicum frutescens abbreviatum** | |
| **Chrysophyllum oliviforme** | Damson plum |
| **Citrus limon** | Lemon |
| **Citrus reticulata** | Tangerine |
| **Dovyalis hebecarpa** | Ceylon gooseberry |
| **Euphoria longan** | Longan |
| **Fortunella japonica var. hazara** | Chinese orange |
| **Garcinia xanthochymus** | |
| **Mammea americana** | Mammee apple |
| **Mimusops elengi** | Elengi |
| **Passiflora laurifolia** | Lemiwai |

*Eutreta xanthochaeta* Aldrich—Mr. Weber reported that in several lots of field-collected galls on *Lantana* held for emergence of this tephritid fly, puparia from which adults later emerged were

found at the bottom of the jars. No previous records are known of *Eutreta* larvae leaving the galls to pupate; it is thought probable that these maggots left the galls because of the drying out of the material.

*A new trichopteron*—Miss Inada reported that on September 29, 1947 Dr. H. A. Banner collected trichopterous larvae in the lily pond at Moanalua Gardens, while collecting plankton material. According to Mr. Zimmerman the larvae appear to be distinct from those collected by him in the same locality in October 1940 (Proc. Haw. Ent. Soc., **11**: 350, 1943) which later proved to be *Oxyethira maya* Denning.

*Chrysobothris* sp.—Mr. Zimmerman exhibited the third example of this immigrant buprestid beetle to be taken in the Territory. It was collected by T. Tanaka, November 22, 1947, at Moiliili, Honolulu. The earlier specimens were collected in the Makiki district of the city in June 1946, and in nearly the same locality in May 1947.

*Exitianus* sp.—Mr. Zimmerman reported that this new immigrant cicadellid leafhopper was first taken in the H.S.P.A. light trap at Iroquois Point, Oahu, October 30, 1947. It was studied by Dr. P. W. Oman of the U. S. National Museum, who states that it appears to belong in the North American *E. exitiosus* (Uhler)—*obscurinervis* (Stål) complex. Essig, in his "Insects of Western North America" calls *exitiosus* "the destructive leafhopper," and notes that "It is widely distributed in North America . . . It may often be present in swarms and is destructive to grasses and grains."

*Two new tenebrionids*—Mr. Zimmerman exhibited two tenebrionid beetles new to the Territory, both taken in the H.S.P.A. light trap at Iroquois Point, Oahu, in November, 1947. One is *Doliema plana* (Fabr.), widespread in the Americas; the other belongs to "a genus near *Palorus*," according to Dr. E. A. Chapin of the U. S. National Museum, who identified both insects.

*Monotoma* sp.—This beetle (see p. 341), first taken in a light trap at Iroquois Point, Oahu, August 4, 1947 (Proc. Haw. Ent. Soc., **13**: 213, 1948) has been identified as belonging to this genus of the family Monotomidae, by W. S. Fisher. Over 250 species are known in this genus, and Mr. Fisher does not give it a specific name.

*A new hydrophilid*—Mr. Zimmerman reported that a hydrophilid beetle of a genus new to Hawaii, was collected from a freshwater pond in Nuuanu, Honolulu, by a student, Takuo Kono, February 23, 1948 (see p. 341). The larvae were seen feeding on mosquito larvae.

*Coconut pests on Palmyra*—Mr. Krauss exhibited adults of a small moth, *Agonoxena argaula* Meyrick (determined by Dr. Swezey) (family Agonoxenidae), the larvae of which he found abundant on coconut foliage on Palmyra Island in February 1948. The larvae feed on the under surface of the leaves and cause elongate brown blotches. Mr. Krauss also noted damage to coconuts by rats on the island, and that coconut crabs (*Birgus latro* Herbst) were fairly common.

*Eurytoma orchidearum* (Westwood)—Mr. Krauss reported that

larvae of this "Cattleya fly," a eurytomid wasp, were causing considerable damage to leafbuds of *Cattleya* orchids in greenhouses at Aiea Heights, Oahu, in February. This species has been reported by growers in Hawaii occasionally over a period of years.

*Pteropus mariannus* Desmarest—Mr. Krauss exhibited a dead fruit bat, or "flying fox," of this species, brought alive to Hawaii from Guam recently. It was confiscated by the Board of Agriculture & Forestry in accordance with Territorial law. This bat feeds on a variety of fruits, and is itself sometimes eaten by natives of Guam. The bat was identified by Mr. Bryan.

## APRIL 12, 1948

The 508th meeting was held at the H.S.P.A. Experiment Station on Monday, April 12, at 2:00 p.m., with President Fullaway in the chair.

*Members present:* Alicata, Bianchi, Bonnet, Fullaway, Joyce, Krauss, Mainland, Nishida, Pemberton, Rosa, Swezey, Tanada, Tuthill, Van Zwaluwenburg and Weber.

*Visitor:* Henry S. Dybas.

Miss Mabel Chong was elected a member of the Society.

### PAPER

Mr. Tanada presented a paper by Curtis W. Sabrosky entitled: "The Muscid Genus Ophyra in the Pacific Region (Diptera)."

### NOTES AND EXHIBITIONS

*Anacamptodes fragilaria* (Grossbeck) — Mr. Bianchi reported finding the caterpillars of this geometrid moth feeding on kiawe (*Prosopis chilensis*) near Kawaihae, Hawaii, March 28; this is a new island record. The caterpillars were fairly abundant there, but at Mahukona, a few miles away, an hour's search revealed only a single dead caterpillar, none alive.

*Achaea janata* (Linn.)—Mr. Bianchi reported that this agrotid moth remains much more common on Hawaii than on Oahu. Near Pahala and Naalehu particularly, fluctuations in *Achaea* populations are reflected by periodic increase and decrease of injury on *Ricinus*, a favored hostplant. On Oahu no feeding on *Ricinus* has been observed for many months, nor has the insect been common on cultivated hosts as was so often the case during the first year of its establishment on Oahu.

*Latrodectus* spp.—Mr. Bianchi reported that on March 26 at South Point, Hawaii, he found almost as many egg cocoons and adults of *L. geometricus* Koch as were present when he last visited the area in 1946. *L. mactans* (Fabr.), on the other hand, has almost disappeared, for a morning's search revealed but one egg case of this species. Of the two parasites previously liberated at South Point, *Baeus californicus* Pierce was found not at all, but *Eurytoma* sp. was extremely abundant, flying about and present in at least 80 per cent of all the egg masses examined.

*Macrosiphum luteum* (Buckton)—It was reported for Mr. Look that he found a heavy infestation of this orchid aphid attacking several species of *Dendrobium* and *Phalaenopsis* at Hilo, Hawaii, in March 1948. The aphid was identified by E. O. Essig. The greatest population was on foliage, flowers and terminal shoots of *D. phalaenopsis* growing in a lath house; only flowers and buds of *Phalaenopsis* were infested. Mr. Krauss added that this same aphid was found by Stephen Au on orchids on Kauai in March (identified by Mr. Weber by comparison with material named by Mr. Essig). In January of this year the species was found infesting *Epidendrum* plants from California in a quarantine house in Honolulu, but this infestation was believed to have been eradicated. However, subsequently Mr. Pemberton reported that *M. luteum* was found by Dr. H. L. Lyon on April 14, infesting flower spikes of *Dendrobium* sp. growing outdoors at Foster Gardens, Honolulu. Hence this new immigrant aphid has been discovered almost simultaneously on Hawaii, Oahu and Kauai.

*Dacus dorsalis* Hendel—Mr. Weber reported the following new host records for this tephritid fly, all supplied from field-collected fruits by the local Division of Foreign Plant Quarantine, U. S. Bureau of Entomology & Plant Quarantine:

| | |
|---|---|
| **Annona reticulata** | Bullock's heart |
| **Artabotrys uncinatus** | Ylang-ylang |
| **Coffea liberica** | Liberian coffee |
| **Flacourtia indica** | Governor's plum |
| **Gossypium barbadense** | Cotton |
| **Inga laurina** | |
| **Manilkara emarginata** | |
| **Murraya exotica** | Mock orange |
| **Noronhia emarginata** | Madagascar plum |
| **Passiflora subpeltata** | |
| **Pimenta dioica (officinalis)** | Allspice |
| **Pimenta racemosa (acris)** | Bay |
| **Pithecellobium (Pithecolobium) dulce** | Opiuma |
| **Polyalthia longifolia** | |
| **Prunus domestica** | Plum |
| **Yucca aloifolia** | |

All the plant identifications, except *Yucca*, are by Miss Marie Neal of the Bishop Museum. In addition to the above named field-collected hosts, *D. dorsalis* was bred in cage tests on apple (*Pyrus malus*) and on bitter melon (*Momordica charantia*).

Mr. Weber also reported specific names for some hosts of *dorsalis* reported to genus only by Mr. Look last year:

Ripe bananas (Proc. Haw. Ent. Soc., **13**: 11); this record is of *Musa nana* (*cavendishii*)
Oranges (l.c.: 13); *Citrus sinensis*
*Prunus* sp. (l.c.: 20); *Prunus salicina* × *P. cerasifera* (Methley plum)
*Passiflora* sp. (l.c.: 20); *P. edulis* var. *flavicarpa*

Mr. Van Zwaluwenburg reported rearing *D. dorsalis* from field-collected fruits of the Chinese banyan (*Ficus retusa*), the Port

Jackson fig (*Ficus rubiginosa*), and the Moreton Bay fig (*Ficus macrophylla*). The fruits of *F. retusa* were collected for him by Masaru Tanaka at Kailua, Oahu, March 1; from about 90 fruits 18 adult *dorsalis* were reared. On March 11 Mr. Rosa and he collected 13 fruits of *F. rubiginosa* at Ewa Plantation Co., Oahu, from which 18 flies (9 males and 9 females) issued between March 29 and April 1. Mr. Rosa and he collected 87 fruits of *F. macrophylla* in Makiki Park, Honolulu, on March 16; 97 flies (54 males and 43 females) emerged from this material between April 1 and April 7. The flies from *retusa* and *rubiginosa* were generally smaller than those from *macrophylla*.

These *Ficus* host fruits are the only three species of the genus for which the specific pollinating wasps have been introduced and become widely established in Hawaii. The Mission Black variety of commercial fig (*Ficus carica*) is usually not pollinated here, but produces edible fruit which is readily attacked by *dorsalis*. Efforts to rear this fly from the sterile fruits of *Ficus heterophylla* have been unsuccessful even though attempted oviposition in them by female *dorsalis* has been observed in the field.

*Stictoptera subobliqua* (Walker)—Mr. Weber exhibited larvae and adults of this agrotid moth, here recorded for the first time from the Hawaiian Islands. It was first taken on *Mammea americana* at the Honolulu Academy of Arts on March 18, 1948, having been called to Mr. Weber's attention by Mr. Duncan of the Academy staff. Larvae have since been found feeding on foliage of *Calophyllum inophyllum* and *Garcinia cambogia*. Typical damage has also been seen on *Garcinia xanthochymus*. According to Swezey (Insects of Guam II: 169, 1946) this moth is known from Ceylon, Sikhim, North Assam, Singapore, British New Guinea and Guam. In Guam it feeds on *Ochrocarpus obovalis;* all its hostplants known so far belong to the family Guttiferae.

*Aphidius* sp.—Mr. Weber exhibited a specimen of this aphid parasite new to the Islands. It was found in a tube of galls of pamakani (*Eupatorium adenophorum*) collected on Tantalus, Oahu, February 24, 1948, which were being held for emergence of parasites of *Procecidochares utilis* Stone, the pamakani tephritid.

*Rhopalosiphoninus latysiphon* (Davidson)—Mr. Krauss exhibited a single alate of this aphid, called the myrtle aphid, collected November 14, 1947 on an unknown hostplant at Olinda, Maui; identification was by E. O. Essig. The species is known from Europe and the San Francisco Bay region of California; it has been recorded from chrysanthemum, cowslip, *Vinca,* Shasta daisy, morning glory and potato. Mr. Pemberton reported that Mr. Bianchi had also collected this aphid at Pohakuloa, Hawaii, while sweeping grass, March 28, 1948. This aphid is new to the Territory.

*New drosophilids*—Dr. Mainland reported the following exotic species of drosophilid flies not previously known from Hawaii,

taken March 18, 1948, in a banana trap on the University of Hawaii campus, Honolulu:

*Drosophila repleta* Wollaston
*Drosophila immigrans* Sturtevant
*Drosophila* sp.

Earlier records of both *repleta* and *immigrans* from the Hawaiian Islands were based on misidentifications.

*Simodactylus marianorum* Van Zwaluwenburg—Mr. Van Zwaluwenburg reported that this elaterid beetle, recently described from Guam, Rota and Tinian (Proc. Haw. Ent. Soc., 13:270, 1948) was collected on Saipan in December by K. L. Maehler.

*Encarsia formosa* Gahan—Dr. Swezey exhibited specimens of this aphelinid which were reared from *Trialeurodes vaporariorum* (Westwood) on *Sonchus oleraceus*. He found parasitized aleurodids by the roadside along Punahou School grounds, March 19, 1948, at the Experiment Station, H.S.P.A. grounds, April 1 and 12, and on Hunnewell St., in Manoa, April 4. Mr. Fullaway recognized the species as one that he introduced in 1942 from the parasite laboratory at Ontario, Canada. It was reared abundantly at that time and liberated on beans heavily infested by *Trialeurodes* at Waianae, Oahu. It had not previously been recovered.

*Bemisia giffardi* (Kotinsky)—Dr. Swezey reported a heavy infestation by this aleurodid on *Clausena lansium* in Foster Gardens, Honolulu, April 3, 1948. Apparently this is a new hostplant for this species which commonly infests various kinds of *Citrus*. Both plants are in the family Rutaceae. The tree was black with sooty mold, which had flourished on abundant honeydew excreted by the aleurodids.

*Insects from dead breadfruit wood*—Dr. Swezey reported the following insects which issued from a dead branch of breadfruit tree in his garden, January 7 to March 29:

100 *Ericryphalus henshawi* Hopkins
453 *Ericryphalus* sp.
2 *Xyleborus fornicatus* Eichhoff
3 *Oxydema fusiforme* Wollaston
1 *Araecerus fasciculatus* (DeGeer)
28 *Oopsis nutator* (Fabr.)
2 *Sybra alternans* Wiedemann
1 *Pterolophia camura* Newman
1 *Lagocheirus obsoletus* Thomson
4 *Opogona purpuriella* Swezey
3 Spalangidae

*Toxoptera aurantii* (Boyer de Fonscolombe)—Mr. Fullaway reported finding this aphid on *Calophyllum inophyllum*, a new host record, at Punaluu, Oahu, March 31.

## MAY 10, 1948

The 509th meeting was held at the H.S.P.A. Experiment Station on Monday, May 10, at 2:00 p.m., with President Fullaway in the chair.

*Members present:* Bianchi, Bonnet, Chong, Fullaway, Holdaway, Joyce, Kartman, Keck, Mainland, Nishida, Pemberton, Rosa, Swezey, Tanada, Tuthill, Van Zwaluwenburg, Weber and Zimmerman.

*Visitor:* Norman E. Flitters.

Mr. Flitters was nominated for membership in the Society.

### PAPERS

Dr. Swezey submitted his paper entitled: "Synonymy of Hypocryphalus mangiferae (Stebbing) and its Occurrence in Hawaii (Coleoptera: Scolytidae)." Mr. Zimmerman presented Dr. Usinger's paper: "War-time Dispersal of Pacific Island Nysius (Hemiptera: Lygaeidae)." Mr. Bianchi presented a paper entitled: "Recent Changes in the Parasite Complex of Armyworms."

### NOTES AND EXHIBITIONS

*Eumenes pyriformis philippinensis* Bequaert—Dr. Swezey exhibited a photograph of a mud nest of this eumenid wasp which Dr. Lyon had found on a *Dendrobium* in his orchid house. He had watched the wasp build one cell after another and store caterpillars in them. Dr. Swezey opened the three central cells to determine the species of caterpillars; they were all the geometrid, *Anacamptodes fragilaria* (Grossbeck), and there were six to eight per cell. One cell contained a nearly full-grown larva. It was fed six caterpillars in addition to those already in its cell, and it had accordingly grown to a larger size than usual. Later note: The wasp failed to issue from the cocoon and on later examination was found to have matured and died within the cocoon.

*Stictoptera subobliqua* (Walker)—Dr. Swezey reported finding three eggs of this most recent immigrant agrotid moth on a leaf of *Calophyllum inophyllum* at the University on April 4. They hatched April 7, and grew rapidly; two pupated on April 22, and reached the adult stage on May 2 and May 4. Thus the larval stage was 15 days, and the pupal stage 10 to 12 days.

*Chelonus texanus* Cresson—Mr. Bianchi reported finding adults of this braconid parasite of armyworms at Honokaa, Hawaii, a new island record. He discussed the present status of armyworms in sugarcane fields on Hawaii, and said that the parasites dominant there at present are the braconids *Meteorus laphygmae* Vlereck and *Apanteles marginiventris* Cresson, and the tachinid *Eucelatoria armigera* (Coquillett).

*Brachymeria fonscolombei* (Dufour)—Mr. Weber exhibited specimens of this new immigrant chalcid (identified by A. B. Gahan), parasitic in blowfly larvae. It was first captured on a store

window at Waipahu, Oahu, August 1, 1947, and later was taken at Kaneohe, Oahu. It is known from central Europe, Russia, Java, Haiti, Mexico and the southern United States as far north as Illinois. Among its recorded hosts the following occur in Hawaii: *Phormia regina* (Meigen), *Phaenicia* (*Lucilia*) *sericata* (Meigen), *Sarcophaga haemorrhoidalis* (Fallen) and *Synthesiomyia nudiseta* (van der Wulp).

New hosts of *Dacus dorsalis* Hendel—The following new host records for this tephritid fly are all from field-collected fruits. (1) Mr. Weber reported for Dr. Ritchie that the local office of the Division of Foreign Plant Quarantines had reared this fly from *Zizyphus mauritiana* on Oahu. (2) Mr. Van Zwaluwenburg reported that Mr. Rosa and he had reared adults from fruits of *Ochrosia elliptica* collected April 15 at the Foster Gardens, Honolulu. (3) Dr. Holdaway and Mr. Tanada recorded breeding *D. dorsalis* from fallen macadamia nuts (*Macadamia ternifolia*) collected by C. Lyman at Pahala, Hawaii, April 14. These nuts had fallen prematurely; some of the larger nuts (all were immature) had split open and had the kernel exposed. From three cracked nuts three adult *dorsalis* emerged. Whether the fly was responsible for the dropping and cracking of the immature nuts, or whether the cause was physiological, is not known. (4) Mr. Flitters reported that Mr. Balock had recently reared 29 *D. dorsalis* from four fruits of *Calophyllum inophyllum*.

*Graphomya maculata* (Scopoli)—Mr. Joyce exhibited a male specimen of this muscid fly (determined by C. W. Sabrosky), taken on a screen, March 2, 1948, at the quarantine station, Ft. Armstrong, Honolulu. This is apparently the first record of its capture in Hawaii. A widespread species, it has been reported from Europe, Alaska, Canada, United States, South America and Australia. The specimen is a pale one, the species usually being darker in color. Further intensive collecting in the Ft. Armstrong area has failed to reveal any more specimens. The females are known to lay only a few eggs, so the species is seldom found in abundance. The proximity of the place of capture to the harbor area suggests that the species was recently introduced through commerce.

*G. maculata* may readily be distinguished from other Muscidae in Hawaii by the following combination of characters: Antennae separated at base by carina; sternopleura with two bristles behind, none in front; propleura bare in middle; pteropleura bare; prosternum bare; squama dusky, lower lobe large, reaching base of scutellum; body gray, partly rufous with well-defined black lines on thorax and black spots on abdomen.

Incidence of *Aedes* in Honolulu—Dr. Bonnet reported on a survey, completed April 20, of the distribution of *Aedes aegypti* (L.) and *A. albopictus* (Skuse) in the city of Honolulu. On 42,764 premises inspected, a total of 1,534 containers were found breeding *Aedes* mosquitoes. Of this number 1,523 were *A. albopictus* and only 11 were *A. aegypti*. All of the *A. aegypti* were found on the

makai (seaward) side of a line drawn along Beretania St. The following table presents data of previous surveys, although it is not known if the figures are all comparable on the basis of sampling methods:

| Year | Per cent *A. albopictus* | Per cent *A. aegypti* |
|---|---|---|
| 1911 | 50 | 50 |
| 1912 | 80 | 20 |
| 1913 | 33 | 67 |
| 1914 | 91.6 | 8.4 |
| 1915 | 91.6 | 8.4 |
| 1926 | 99.2 | 0.8 |
| 1943 | 85 | 15 |
| 1944 | 93.5 | 6.5 |
| 1948 | 99.3 | 0.7 |

Mr. Kartman remarked that in his experience during the recent war, in both East and West Africa, *Aedes aegypti* was never found as adult or larva in dwellings, but that the adults were invariably found away from habitations, and their larvae in tree-holes and in water-holding plants. These observations, the reverse of those for this species in the Americas, were corroborated elsewhere in Africa by other groups studying *A. aegypti.*

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## JUNE 14, 1948

The 510th meeting was held at the H.S.P.A. Experiment Station on Monday, June 14, at 2:00 p.m., with President Fullaway in the chair.

*Members present:* Beller, Bianchi, Bryan, Carter, Fullaway, Holdaway, Inada, Joyce, Keck, Mainland, Pemberton, Rosa, Schmidt, Tuthill, Van Zwaluwenburg, Weber and Zimmerman.

*Visitor:* Lew E. Wallace.

Norman E. Flitters was elected to membership, and the name of Lew E. Wallace was proposed for membership.

### PAPER

Mr. Zimmerman presented a paper by H. F. Strohecker entitled: "The Genus Spathomeles Gerstaecker, with the Description of a New Species from Borneo (Coleoptera: Endomychidae)."

### NOTES AND EXHIBITIONS

*Insect swarms in southerly weather*—Dr. Carter reported that Iichi Yanagihara observed flights of great numbers of a small, unidentified staphylinid beetle on April 2 and April 8, and a flight of some 50 oedemerids, *Ananca bicolor* (Fairmaire), all in Honolulu. All these observations were made during "kona" weather.

*Oechalia pacifica* (Stål)—Dr. Tuthill reported the finding of this pentatomid bug in considerable numbers on Koko Head, Oahu,

May 16. The bugs were on *Crotalaria,* where they were apparently preying on lycaenid larvae. Mr. Van Zwaluwenburg reported that J. D. Bond had recently found nymphs of this bug in Manoa Valley, feeding on the larvae of the chrysomelid, *Lema trilineata californica* Schaeffer, on *Datura.*

*A new slug*—Dr. Tuthill exhibited specimens of what appears to be a new slug. They are about as large as the common black slug (*Veronicella*) and were found in trash about the base of a dead papaya tree on the University campus. Later this slug was identified by Dr. A. R. Mead as *Limax flavus* (L.).

*Aphycus terryi* Fullaway—Mr. Pemberton remarked that this encyrtid parasite of the gray mealybug, *Pseudococcus boninsis* (Kuwana), which was introduced into Louisiana from Hawaii in 1932 by Dr. Swezey, had subsequently been reported to be well established there. However, taxonomic studies by A. B. Gahan (Proc. U. S. Nat. Mus. **96**, no. 3200: 321-324, 1946) have shown that field-collected material from Louisiana, supposed to be *A. terryi,* proved without exception to be a new species, described by him as *Pseudaphycus mundus.* All evidence indicates that *A. terryi* is not established in Louisiana.

*Calosoma blaptoides* Putzeys subsp. *tehuacanum* (Lapouge)—Mr. Pemberton stated that he had recently had opportunity to compare critically, named specimens of *Calosoma semilaeve* LeConte, with specimens of *Calosoma* established at Waikii, Hawaii (Proc. Haw. Ent. Soc. **13**: 210, 1948), and that they are different. Specimens of the local *Calosoma* were sent to Dr. E. C. Van Dyke who replied on May 23, that our species is *blaptoides tehuacanum.* This proves to be the species introduced into Hawaii from Cuernavaca, Mexico, by H. T. Osborn in September 1923. At that time 30 adult beetles were liberated at Waikii, Hawaii; the species was not seen again until May 1947 when Dr. Swezey and W. C. Look recovered specimens in the general vicinity of the original liberation. When this recovery was reported last year it was assumed that the beetle was *C. semilaeve* because a large number of that species imported from Ventura County, California, in 1923 were also liberated at Waikii. The Mexican introduction was apparently overlooked.

*Monotoma* near *picipes* Herbst—Mr. Pemberton reported that this beetle, previously taken only in a light trap on Oahu, was taken in numbers similarly by Henry Alexander at Lahaina, Maui, June 1, 1948. This is a new island record.

*Dacus dorsalis* Hendel—Dr. Carter discussed the present status of this fruitfly in regard to pineapples, and concluded that this fruit is a definitely unfavorable host for the fly, in which it can only rarely reach maturity. Mr. Pemberton remarked that from six mango fruits collected May 15, and believed by the grower to be free of *Dacus,* a total of 936 *D. dorsalis* adults were reared. Mr. Weber reported rearing a single specimen of *D. dorsalis* from a small, immature coconut. The larva was found under the cap,

where the tissue at the top of the nut had begun to decay. It is not known if the decay was a predisposing factor to oviposition.

Dr. Mainland reported that in the female *D. dorsalis* dissection has revealed that the hind-gut and the posterior vagina are united into a common duct, a cloaca, just anterior to the last plate of the ovipositor. At the time of defecation the ovipositor is usually fully extended. Since the posterior genital tract and the posterior gut are united, it appears probable that the surface of all eggs may be contaminated by microorganisms present in the hind-gut at the time of oviposition.

*Syritta orientalis* Macquart—Mr. Weber exhibited a specimen of this syrphid fly, new to the Territory. It was first taken at Punaluu, Oahu, October 7, 1946, and has since been taken at Hickam Field and in Honolulu. The species is known from Java and Singapore; identification was by C. T. Greene.

*Pison insulare* Smith—Mr. Weber exhibited a series of this new sphecid wasp, first captured on the Kawaiiki trail, Oahu, November 2, 1947 (Proc. Haw. Ent. Soc., **13**:222, 1948; as *Pison* sp.). The species was identified by K. V. Krombein; it is known from the New Hebrides.

*A new corizid bug*—Mr. Bianchi exhibited a series of a bug new to the Territory. It was found by Mr. Bianchi near a pineapple field at Poamoho, Oahu, May 26, 1948. A large number of adults and nymphs were present on ground with a thick weed cover in an area about 10 by 40 feet. The nymphs of all stages greatly resemble ants, both in movement and appearance. It feeds on a variety of legumes, and drops its eggs loosely instead of attaching them to the host plant. Later this insect was identified by Dr. P. W. Oman as *Coriscus pilosulus* (Herrick-Schaeffer), which occurs in the United States but is of no economic importance there.

*Caenis* sp.—Mr. Bianchi reported this ephemerid, known here only since 1944, to be extremely abundant at lights at Kailua, Oahu, June 11.

*Ceroplastes rubens* Maskell—Dr. Carter exhibited a mango leaf heavily infested by this wax scale. The tree had been given heavy applications of DDT about a year ago in an effort to combat *Dacus dorsalis*. The scale infestation on this particular tree is in striking contrast to untreated trees nearby which are relatively free from the scale.

*A new gall midge*—For Mr. Look it was reported that a heavy infestation of a cecidomyiid gall midge new to these islands, was found by him damaging leaves and stems of chrysanthemum grown under glass at Wainaku, Hilo, Hawaii, on May 14, 1948. Subsequently Dr. H. F. Barnes of Rothamsted, England, identified it as the chrysanthemum midge, *Diarthromyia chrysanthemi* Ahlberg (Ent. Tidskrift, **60**:274, 278, 1939; new name for *D. hypogaea* Felt, not Loew). To paraphrase Dr. Barnes' remarks: This is a well known pest in the United States, and sporadic outbreaks have

occurred in European countries, which have usually been traced back to importations of chrysanthemum cuttings from America. It is now well established in Europe. It was formerly known as *D. hypogaea* (F. Loew), a species described from wild chrysanthemum root galls in Europe. It is now generally accepted that the midge on cultivated chrysanthemums is distinct from *hypogaea*. Apparently the American species was misidentified. Dr. Barnes suggests nicotine dipping of cuttings, and routine sprays with nicotine.

*Hercinothrips femoralis* (Reuter)—Mr. Fullaway reported a heavy infestation by this thrips on *Crinum* lilies in Honolulu, June 7. This is a new host record.

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## JULY 12, 1948

The 511th meeting was held at the H.S.P.A. Experiment Station on Monday, July 12, at 2:00 p.m., with President Fullaway in the chair.

*Members present:* Bianchi, Bonnet, Bryan, Courtney, Flitters, Fullaway, Inada, Joyce, Kartman, Keck, Mainland, Nishida, Rosa, Schmidt, Stout, Tanada, Tuthill, Van Zwaluwenburg and Weber.

Lew E. Wallace was elected to membership in the Society.

### PAPER

Mr. Bianchi presented a paper: "New Thrips Records and Species from the Marianas."

### NOTES AND EXHIBITIONS

*A new muscid fly*—Mr. Joyce reported that six specimens of *Muscina stabulans* (Fallen) were taken in a rat-baited trap at Ft. Armstrong, Honolulu, June 13, 1948. This appears to be a new record for the Islands, although specimens have been recovered from planes arriving in Honolulu in past years. The adults of *M. stabulans* are very similar to the common housefly in appearance, but may be readily distinguished by the wing venation. The fourth longitudinal vein is bent feebly upward, not sharply bent as in *Musca domestica* L. *M. stabulans* occurs in houses as well as in stables, etc., and is sometimes called the non-biting stable fly. The larvae normally breed in manure and decaying matter, and have been reared from and captured on human excreta and cadavers. The female frequently oviposits on food, and the larvae have been involved in cases of intestinal myiasis in man. *M. stabulans* is almost cosmopolitan, being known from all the continents as well as from some of the Pacific islands.

*Linognathus setosus* (Olfers)—Mr. Joyce exhibited a specimen of this sucking louse of dog, found on a stray dog at Ft. Armstrong, Honolulu, May 5, 1948. Apparently the species has not previously been reported from Hawaii, although it is possible that

it has been here for some time. It is occasionally abundant on poorly kept dogs in every part of the world.

*Dacus dorsalis* Hendel—Dr. Schmidt commented on the high mortality of maggots of this fruitfly observed in unbroken mangoes. Mr. Fullaway suggested that some of it may have been due to sun heat, and others suggested the possible killing effect of fermentation.

*Agonoxena argaula* Meyrick—Mr. Van Zwaluwenburg exhibited coconut leaves damaged by an insect new to the Territory, an agonoxenid moth first found at Kahala, Honolulu, by Mr. Pemberton and himself, June 28, 1948. Infestation is heavy at Kahala and at Kaalawai, where the insect may have been present for many months. Light infestations were later found at Ft. Ruger and in Manoa Valley. Feeding is confined to the epidermis on the underside of the leaves. The feeding scar of the young larva is long and narrow, spreading into wide, irregular blotches as the caterpillar grows. Feeding areas turn brown and are conspicuous. The caterpillar is yellowish green and feeds beneath a web; it does not tie up the leaf as *Omiodes* does. Pupation takes place beneath a close, elongate, white web on either the upper or lower leaf surface. The egg is not known. From Kahala material a small specimen of *Zaleptopygus* (*Cremastus*) *flavo-orbitalis* (Cameron) emerged, and later investigation indicates that parasitism of *Agonoxena* by this ichneumonid is considerable.

Reared specimens agree well with the description of *A. argaula* (Exotic Microlep., 2: 472, 1921). The species was described from Fiji, and is known also from Samoa, the Ellice Islands and Palmyra. A related species, *A. pyrogramma* Meyrick, occurs in New Guinea, New Britain, the Solomons and Guam. Both species feed on coconut leaves. At Kahala typical *argaula* feeding was also seen on fan palm (*Pritchardia*).

*Polydesma umbricola* Boisduval—Mr. Van Zwaluwenburg reported a new hostplant for this agrotid moth. With Chester Wismer and Mr. Rosa he recently observed feeding by its larvae on pink shower (*Cassia grandis*) in Honolulu. Previously it was known only on *Albizzia lebbek, Pithecolobium dulce* and monkeypod.

*Pseudoparlatoria parlatorioides* (Comstock)—Mr. Fullaway exhibited specimens of this diaspine scale taken on *Cypripedium* orchids in Honolulu in June, 1948. This is a new insect for the Islands; the identification was by Mr. Fullaway.

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## AUGUST 9, 1948

The 512th meeting was held at the H.S.P.A. Experiment Station on Monday, August 9, at 2:00 p.m., with President Fullaway in the chair.

*Members present:* Balock, Beller, Bryan, Carter, Fullaway, Holdaway, Inada, Joyce, Keck, Mainland, Pemberton, Rosa, Stout,

Tanada, Tuthill, Van Zwaluwenburg, Wallace, Weber, and Zimmerman.

*Visitors:* Mrs. Lilla Armstrong, Miss Betty Lou Pelot, Dr. A. C. Baker and Dr. C. L. Marlatt.

Miss Pelot was nominated for membership in the Society.

Dr. Marlatt gave interesting reminiscences of his earlier visits to Hawaii. Mr. Beller presented the Society with a copy of his "Summary of the Insects and Flora of Guam," and Mr. Bryan distributed copies of his "Bibliography of Micronesian Entomology."

PAPER

Dr. Carter presented a paper by A. B. Gahan entitled: "Identity of the Anagyrus that Parasitizes the Pineapple Mealybug (Hymenoptera: Chalcidoidea: Encyrtidae)." The following paper was presented for K. V. Krombein: "Two new Wasps from Melanesia and Notes on a Third recently introduced into Hawaii (Hymenoptera: Sphecidae)."

NOTES AND EXHIBITIONS

*Diorymerellus* sp.—Dr. Carter exhibited an adult weevil of this genus which issued from a *Cattleya* plant in his orchid house on August 7. The orchid originated in Venezuela and the emergence of the weevil despite the treatment the plant had undergone in quarantine, emphasizes the difficulty of keeping out of the Territory certain types of insects from foreign countries.

*Eumenes pyriformis philippinensis* Bequaert—Mr. Van Zwaluwenburg presented rearing notes on this wasp. A broken nest containing an incomplete complement of immobilized caterpillars (only four *Anacamptodes* larvae were present instead of the usual six or eight) and a *Eumenes* egg, was received on the afternoon of July 8. By 8 a.m. the next day, the egg had hatched, and by 8 a.m. July 12, the *Eumenes* grub had entirely consumed the larvae present, and though apparently full grown, searched about for additional food for the next two days. Finally by July 15 it had spun a loose web of silk, had turned from white to yellow in color, and lost its mobility. Pupation occurred between July 17 and 19; the adult wasp issued July 30-31, but lay quiescent for two days before becoming active. The larval stage lasted between 8 and 11 days, and the pupal stage, 11-14 days. Because it had less than the usual number of caterpillars for food, the reared wasp was somewhat undersized.

In a general discussion of *Dacus dorsalis* Hendel, Dr. Baker stressed the value of field studies as an aid to segregating various species of fruitflies which superficially, and based on accepted taxonomic characters, appear to be the same but are actually distinct.

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## SEPTEMBER 13, 1948

The 513th meeting was held at the H.S.P.A. Experiment Station on Monday, September 13, at 2:00 p.m., with President Fullaway in the chair.

*Members present:* Bonnet, Bryan, Carter, Fullaway, Inada, Joyce, Keck, Mainland, Nishida, Pelot, Pemberton, Ritchie, Rosa, Stout, Tanada, Tuthill, Van Zwaluwenburg and Weber.

*Visitors:* Dr. Henry A. Bess, Ellery W. French and Dr. Stephen M. K. Hu.

Miss Betty Lou Pelot was elected to membership. Dr. Bess and Dr. Hu were nominated for membership and Ellery French for associate membership. Mr. Bunki Kumabe of Maui was nominated for corresponding membership.

NOTES AND EXHIBITIONS

*Grapholitha molesta* (Busck)—Dr. Tuthill reported finding a nearly mature larva of the oriental fruit moth in an apparently sound plum from California, purchased locally.

*Dacus dorsalis* Hendel—Mr. Weber reported rearing this tephritid fly from grapefruit obtained on August 11; the infested fruits were from a store in Kapahulu, Honolulu, where they had been exposed for an unknown time. He also reported that *D. dorsalis* had earlier been reared from the star apple (*Chrysomphyllum cainito*) by Miss Chong, but that the record had until now been overlooked.

Mr. Tanada reported that Dr. Holdaway and he reared 33 *D. dorsalis* adults from four bell peppers (*Capsicum frutescens grossum*) collected at Pahoa, Hawaii (600 ft. elev.) by M. Ueda, July 13. From the peppers was also reared one specimen of *Opius fletcheri* Silvestri (det. C. E. Pemberton). Bell pepper is also a host of *Dacus cucurbitae* Coquillett, so it is not certain that the parasite was attacking *dorsalis* in this instance, even though no *cucurbitae* were obtained. However, it is of interest to note that the Board of Agriculture and Forestry has reared *fletcheri* from *D. dorsalis* in the laboratory.

Mr. Van Zwaluwenburg reported that Mr. Rosa and he had reared six *D. dorsalis* from 38 fruits of the introduced kou, *Cordia sebestena.*

*Eumenes latreillei petiolaris* Schulz—Mr. Weber reported that this wasp was seen by Stephen Au on August 19 in the Makaweli district of Kauai, where it is known to have been present since at least June of this year. This is a new island record.

*Agonoxena argaula* Meyrick—Mr. Van Zwaluwenburg reported further hosts of this recently discovered moth, most of them identified by Mr. Weber. Besides coconut and *Pritchardia* palms, larvae have been found feeding extensively on leaves of *Kentia* palm; bottle palm, *Hyophorbe amaricaulis;* and areca palm, *Chrysalidocarpus lutescens.*

*Cerambycid in orchids*—Mr. Weber spoke of damage done to pseudo-bulbs of certain orchids. (*Dendrobium* and *Cattleya*) by cerambycid larvae identified by the U. S. National Museum as belonging to the subfamily Lamiinae. A number of these larvae have been taken recently in local orchid houses. Later note: Reared

specimens subsequently proved to be the common immigrant, *Sybra alternans* Wiedemann.

*Orosius argentatus* (Evans)—Mr. Fullaway called attention to a paper (Journ. Counc. Sc. and Ind. Res., 16: 86-90, Canberra, 1943) in which a virus disease of tomatoes and certain ornamentals in Australia, called "big bud of tomato," is shown to be transmitted by this cicadellid. The species does not occur in Hawaii; *Nesaloha cantonis* Oman is a synonym.

Damage to *Albizzia*—Mr. Pemberton exhibited a branch of *Albizzia saponaria* which showed to an exaggerated degree bud swellings such as have commonly been attributed to feeding on the unopened buds of monkeypod by the agrotid moth, *Polydesma umbricola* Boisduval. However, Dr. Carter said that similar damage to monkeypod (*Samanea*) had been familiar to him long before the advent of *Polydesma* to the Territory, and that therefore the swelling of the buds could be caused by other factors in addition to the work of *Polydesma*. A buprestid larva was present in one of the semi-decayed buds, which on rearing to adult later proved to be *Agrilus extraneus* Fisher, an immigrant species known here as early as 1908, and described in 1933. It is known only from Oahu.

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## OCTOBER 11, 1948

The 514th meeting was held at the H.S.P.A. Experiment Station on Monday, October 11, at 2:00 p.m., with Vice-President Balock in the chair.

*Members present:* Alicata, Balock, Bess, Bonnet, Flitters, Hu, Inada, Joyce, Keck, Lewis, Look, Maehler, Mainland, Marlowe, Nishida, Pelot, Pemberton, Ritchie, Rosa, Ross, Stout, Swezey, Tanada, Tuthill, Van Zwaluwenburg and Zimmerman.

*Visitors:* Dr. D. W. Clancy, Dr. D. E. Hardy, F. G. Hinman and L. B. Loring.

Dr. H. A. Bess and Dr Stephen M. K. Hu were elected to membership, Ellery W. French to associate membership, and Bunki Kumabe to corresponding membership in the Society. The following were nominated for membership: Dr. Clancy, Dr. Hardy and Mr. Hinman.

### PAPER

Mr. Van Zwaluwenburg presented: "Notes on Parasites of Agonoxena argaula Meyrick."

### NOTES AND EXHIBITIONS

*Vanduzea segmentata* (Fowler)—Miss Inada exhibited specimens of a membracid new to the Territory, which she and T. Kono collected in Honolulu, August 17, 1948, on eggplant. Nymphs and adults were seen feeding at the stem ends, and a few were seen on the calyx of the fruit also. Most of them were attended by *Pheidole megacephala* (Fabr.). The membracid was identified by Miss Louise M. Russell of the U. S. National Museum; she states

that the recorded distribution of this insect is Arizona, Texas, Louisiana, Mexico and Central America. Recently, among student collections at the University, Dr. Tuthill found this same species collected April 20, 1948, Honolulu, without hostplant data.

*Sarcophaga ruficornis* (Fabr.)—Mr. Joyce reported this fly, new to the Islands, taken by him in Honolulu, July 16, 1947, and found also in the H.S.P.A. collection where 2 males and 1 female are present, collected in Honolulu, May 3, 1940, by O. H. Swezey. The species has a wide distribution, mainly oriental: Ceylon, Chagos Islands, India, Malay States, Formosa, Philippines, China (Hong Kong) and northeast Africa. It is said to cause occasionally a very severe form of dermal myiasis in India, and has also been reported in intestinal myiasis.

*Dacus dorsalis* Hendel—Mr. Nishida reported a new host fruit for this fly. From 24 ripe fruits of the latania palm (*Latania loddigessii*) picked up from the ground, 288 adult *D. dorsalis* emerged. Infestation apparently does not take place while fruits are still on the tree, for no flies were obtained from 12 ripe and 13 immature fruits picked from the tree.

Mr. Pemberton stated that O. C. Chock of the Board of Agriculture and Forestry had reported to him that he had reared *Dirhinus giffardii* Silvestri, *Spalangia philippinensis* Fullaway, *Tetrastichus giffardii* Silvestri and *Pachycrepoideus dubius* Ashmead from puparia of *D. dorsalis* in the outdoor laboratory of the Board in Honolulu. These puparia were obtained from guavas collected on Oahu. The pupal parasites *Dirhinus* and *Spalangia* must have entered the laboratory from the adjacent grounds, whereas *Tetrastichus* and *Pachycrepoideus* could have parasitized the fly larvae in the field before the fruit was collected, or they could have entered the laboratory and parasitized the larvae after the fruit was brought in. All of these insects have been established in the Territory for many years and have formed part of the complex of Mediterranean fruitfly parasites. Mr. Chock also reported recently rearing good numbers of *Opius longicaudatus* (Ashmead) from *D. dorsalis* from guavas collected in Nuuanu Valley, Honolulu. This is the first recovery of this opiine, which was imported from the Malay Peninsula during the summer of 1948. *O. longicaudatus* was described from the Philippines as a *Biosteres* (Proc. U. S. Nat. Mus., **28**: 970, 1905).

*Dacus cucurbitae* Coquillett—Mr. Nishida reported rearing 10 adults of the melon fly from 3 fruits of *Passiflora seemanni*. This is a new host record; the fruit was identified by W. B. Storey.

*Aceria litchii* (Keifer)—Mr. Nishida reported that, according to a recent letter from H. H. Keifer, the name of the litchi erinose mite is now *Aceria litchii*. Formerly it was referred to in the local literature as *Eriophyes chinensis* Trotter, and more recently as *Eriophyes litchii* Keifer.

*Oryctes rhinoceros* (L.)—Dr. Alicata said that losses from this insect are so severe and remedial measures so inadequate, that planters in Western Samoa are reported shifting from coconut to cacao culture.

## NOVEMBER 9, 1948

The 515th meeting was held at the H.S.P.A. Experiment Station on Monday, November 9, at 2:00 p.m., with Vice-President Balock in the chair.

*Members present:* Balock, Bess, Bianchi, Bonnet, Clancy, French, Hardy, Hinman, Hu, Inada, Joyce, Look, Nishida, Pelot, Pemberton, Rosa, Schmidt, Swezey, Tuthill and Van Zwaluwenburg.

*Visitor:* C. W. Schwabe.

Dr. D. W. Clancy, Dr. D. Elmo Hardy and F. G. Hinman were elected to membership. C. W. Schwabe was nominated for associate membership.

### PAPERS

Dr. Tuthill presented a paper by Calvin W. Schwabe entitled: "Observations on the Life History of Pycnoscelus surinamensis (Linn.), the intermediate Host of the Chicken Eyeworm in Hawaii"; K. V. Krombein's paper was presented: "The Aculeate Hymenoptera of Micronesia. I. Scoliidae, Mutillidae, Pompilidae and Sphecidae."

### NOTES AND EXHIBITIONS

*Phytomyza spicata* Malloch—Mr. Pemberton reported finding this agromyzid fly mining leaves of Johnson grass at Wailuku, Maui, November 5. Mr. Van Zwaluwenburg added that he had found the same fly in *Setaria verticillata* at Mapulehu, Molokai, November 4. Both are new island records.

*Leptomastix dactylopii* Howard — Dr. Swezey exhibited both sexes of this encyrtid, reared from a light infestation of *Pseudococcus citri* (Risso) on poinsettia leaves in Honolulu. Sixteen of the parasites issued October 20-22, a single parasite per host mealybug. The first record of this species in Hawaii was by D. T. Fullaway in February 1945 (Proc. Haw. Ent. Soc. 12: 464, 1946) of specimens reared from a mixed infestation of *Phenacoccus gossypii* Towns. & Ckll. and *Pseudococcus kraunhiae* (Kuwana) on soybean and eggplant. Mr. Fullaway considered it to be an accidental introduction from California. Harold Compere (Univ. Calif. Pub. in Ent., **7**, no. 4: 57, fig. 1) records it in California as having issued (a single pair) in December 1934, from *Pseudococcus citri* imported from Brazil. The progeny of this pair increased to more than 4 million within a year, and were distributed to the orchards of California. The species was described in 1885 (U. S. Bur. Ent., Bull. **5**: 23).

*New host of melon fly*—Dr. Hardy reported that *Dacus cucurbitae* Coquillett was recently reared from kai choy (*Brassica juncea*) from Hilo. This apparently is a new host record and establishes the fact that this fly will attack at least some of the cabbages. The Assistant County Agent at Hilo reported infestations on kai choy rather general in the Hilo area, and that the fly is causing severe damage in some fields.

*Dacus dorsalis* Hendel — Mr. Van Zwaluwenburg reported finding eggs and larvae of the oriental fruitfly in berries of the beach naupaka (*Scaevola frutescens sericea*) collected by Mr. Pemberton and himself at Kawela Bay, Oahu, October 17. Apparently this host is not a very favorable one for the fly, for later it was found that none of the maggots in this lot of material succeeded in forming puparia. However, a single adult *dorsalis* was bred from *Scaevola* berries collected later in the same area.

*Sarcophaga ruficornis* (Fabr.)—Mr. Joyce recorded the occurrence of this fly on Kauai, based on collections by F. G. Holdaway at Wailua ranch, December 11, 1940 (3 males and 3 females), and at Kapaa, December 21, 1940, from manure (1 female).

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## DECEMBER 13, 1948

The 516th meeting was held at the H.S.P.A. Experiment Station on Monday, December 13, at 2:00 p.m., with Vice-President Balock in the chair.

*Members present:* Balock, Bess, Bianchi, Bonnet, Bryan, French, Hardy, Hu, Inada, Joyce, Keck, Lewis, Look, Nishida, Pelot, Ritchie, Rosa, Schmidt, Schwabe, Stout, Suehiro, Swezey, Tuthill, Van Zwaluwenburg and Zimmerman.

*Visitor:* L. Schoening.

C. W. Schwabe was elected to associate membership.

It being the annual meeting, the following slate of officers to serve during the coming year, was presented:

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|---|---|
| President | J. W. Balock |
| Vice-President | L. D. Tuthill |
| Secretary-Treasurer | R. H. Van Zwaluwenburg |
| Additional members of Executive Committee | D. T. Fullaway<br>C. R. Joyce |

There were no further nominations, so the above nominees were elected.

In the absence of the President, Vice-President Balock read Mr. Fullaway's presidential address: "Dacus dorsalis Hendel, in Hawaii."

### PAPERS

A paper by O. C. McBride and Y. Tanada was presented, entitled: "A Revised List of Host Plants of the Melon Fly in Hawaii." Mr. Zimmerman presented his paper: "A new Dynatopechus Weevil injuring Lima Beans in Hawaii (Coleoptera: Curculionidae)."

### NOTES AND EXHIBITIONS

*Opius persulcatus* (Silvestri)—A note was presented for Mr. Pemberton in which it was reported that Q. C. Chock had reared this opiine parasite from puparia of *Dacus dorsalis* Hendel ob-

tained from field-collected fruit on Oahu during November 1948. This parasite was introduced from the Philippines and the Malay Peninsula during 1948. It is the second parasite on *D. dorsalis* to become established here, the first being *Opius longicaudatus* (Ashmead). *O. persulcatus* was described from India as *Biosteres* (Boll. Lab. Zool., Portici, **11**: 167, fig. 5, 1916).

*Identifications of new immigrant insects*—Mr. Zimmerman reported the identifications of some recent immigrant insects, received from the U. S. National Museum:

*Fulvius brevicornis* (Reuter), Heteroptera: Miridae; determined by R. I. Sailer (see *Fulvius* sp., Proc. Haw. Ent. Soc., **13**: 213, 1948).

The monotomid beetle believed to be a fungus feeder, reported earlier this year (see p. 323) is near *Monotoma picipes* Herbst, a widespread species, but L. L. Buchanan reports that our specimen sent for comparison is paler and somewhat broader than any specimens under this name in the National Museum collection.

*Tropisternus lateralis* var. *dorsalis* Brullé, is the hydrophilid beetle reported at the March meeting (see p. 323); it is known from western North America and from Central and South America. Mr. Buchanan identified the beetle.

*Chrysobothris* sp. This buprestid beetle, first taken in Hawaii in 1946 (Proc. Haw. Ent. Soc., **13**: 12, 1947) has been determined by W. S. Fisher as near *Chrysobothris tristis* Deyrolle, from the Austro-Malayan region.

*Diaperis maculata* Olivier; this is the red and black tenebrionid beetle first taken at Iroquois Point, Oahu, in 1947 (Proc. Haw. Ent. Soc., **13**: 212, 1948). It is a variable, widespread species, and was identified by Dr. R. E. Blackwelder.

*Recent coccinellid introductions*—Mr. Zimmerman reported that during the year the following African Coccinellidae were introduced into Hawaii by the H.S.P.A. Experiment Station in cooperation with the Division of Biological Control, University of California: *Scymnus*, species not known; *Scymnus binaevatus* (Mulsant); and *Scymnus quadrivittatus* (Mulsant). The first species was released in Manoa Valley, Oahu, in January; *S. binaevatus* was released at Makiki and Manoa, Honolulu, in January, in Manoa Valley and in the Foster Gardens, Honolulu, in April, and on Lanai, and again in Manoa Valley in February. *S. quadrivittatus* was released at Manoa in January and May, and at Kunia, Oahu, in March. Details of these introductions are in the files of the Experiment Station, H.S.P.A. It is hoped that these species will become established as predators on some of the mealybugs occurring here.

*Dacus dorsalis* Hendel—Mr. Zimmerman reported that two adult flies of this species were bred from 97 ripe olives (*Olea europaea*) from the G. R. Carter estate at Kulamanu, Maui, collected November 24. This is a new host record for the oriental fruitfly.

## The Insect Guide. Orders and Major Families of North American Insects[1]

(A Review)

By L. D. TUTHILL

In the author's words the purpose of this book is, "to present the insects of North America north of Mexico, in pictures and in non-technical language, at the family rather than at the species level . . ." This purpose is well accomplished. Accepting the fact that the ordinary user of such a guide book will primarily look through the pictures to identify a specimen, Dr. Swain has built the entire book on this basis. There are no keys. The method of use is to look through the plates of illustrations which include at least one representative of each family covered. These illustrations are numbered to correspond to the numbers of the families as given in the text. The illustrations are, fortunately, very good. The colored plates are especially fine.

The introductory section includes a thoroughly condensed minimum of general information on insects and their near relatives, structure, development, behaviour, history, relationships with man and other organisms, and a short section on how to use the book.

Following the treatment of the orders and families, arranged in the usual order beginning with the Apterygota, a chapter on collecting, preserving and studying insects, a well selected list of references, and a good index conclude the volume.

The end papers bear an attractive tabular synopsis of the 26 orders considered in the book. The size of the book is convenient, 7½ x 4¾ inches. It is well bound in an attractive cloth cover.

[1] By Ralph B. and SuZan N. Swain; xlvi+261 pp., 15+48 col. pls. Doubleday and Co., New York, 1948. Price $3.00.

## Insects of Hawaii[1]

(A Review)

By R. H. VAN ZWALUWENBURG

This excellent work is the result of over fourteen years of scholarly effort by an author well qualified to bring together and to interpret the great mass of information on the insects of these Islands which has accumulated since the publication of "Fauna Hawaiiensis" nearly half a century ago. "Insects of Hawaii" is the result of cooperation by three scientific agencies in the Territory: the Bernice P. Bishop Museum, the Experiment Station, Hawaiian Sugar Planters Association, and the University of Hawaii, all of which contributed financially or otherwise to its production. It is the third publication to appear under the auspices of the recently created University of Hawaii Press.

For some fifty years "Fauna Hawaiiensis" has been the sourcebook of Hawaiian entomology. Useful though the "Fauna" will always be, so much new information has been gathered, and so many new insects, both native and immigrant, have been found here since its publication, that it is no longer adequate for the student whose first problem often is to know just what species he has in hand. So these volumes fill a real need, and indeed, are indispensable. They not only offer workable keys for identifying the local fauna, but in addition are a storehouse of information concerning the biology of the Hawaiian insects, their origins, importance to agriculture and health, their natural enemies, and, in the case of economic species, their control. The assembling of so much widely scattered, and often inaccessible data between the covers of a few volumes is a concrete contribution to Pacific biological science.

The five volumes consist of some 1700 pages; they contain some 3000 illustrations and about 275 keys for insect identification. The taxonomic pages treat in progressive order from the primitive to the more highly developed orders, the groups from the Thysanura through the mealybugs and scale insects. Later volumes, for which the groundwork has already been done, will discuss in similar manner the rest of the insect orders: the minor orders not previously considered, and the Lepidoptera, Coleoptera, Hymenoptera and Diptera.

In the chapter on the geological history of Hawaii in his "Introduction," the author discusses in clear, yet detailed fashion, the formation of the islands, their degradation (by marine action and erosion), their partial submergence and re-emergence, the age of the island chain and the comparative ages of the individual islands. In the chapter on "Dispersal" are discussed the means whereby plants and animals are spread about the world. The greatest hazard en-

[1] By Elwood C. Zimmerman. Vol. 1, Introduction, xx+206 pp. $3.50; Vol. 2, Apterygota to Thysanoptera inclusive, viii+475 pp. $5.50; Vol. 3, Heteroptera, i+255 pp. $4.50; Vol. 4, Homoptera: Auchenorhyncha, vii+268 pp. $4.50; Vol. 5, Homoptera: Sternorhyncha, vii+464 pp. $6.00. University of Hawaii Press, 1948. Honolulu.

countered by an immigrant species, it is pointed out, is its successful establishment in a foreign and often hostile environment; the percentage of failures is extremely high. Analysis of the native Hawaiian fauna leads the author to conclude that ". . . only about 250 overseas stragglers succeeded in becoming established . . . perhaps one successful colonization per 20,000 years!" From these few successful immigrants has the native Hawaiian insect fauna developed. Parenthetically, it is interesting to compare the meager success of insect immigration unaided by man, with the situation today. In spite of quarantines, not less than 45 immigrant insect species have arrived in Hawaii and established themselves here within the past four years.

In the chapter on "Analyses and Summaries of the Hawaiian Biota," Mr. Zimmerman points out that the number of indigenous insects is small in comparison with the endemic species; the latter approximate 99 per cent of the native species. Nearly two-thirds of the major insect groups known in the world are entirely absent from the native Hawaiian fauna, and these absentees are mainly among the geologically ancient orders. "There is no evidence whatsoever to indicate that there was any Hawaiian continental land mass or that these islands were ever connected by dry land to any continent. The very character of the fauna expresses the essence of oceanic isolation." The affinities of the native insects are over 90 per cent Pacific, and it is "noteworthy that most of the American elements are large, strong-flying insects." This chapter includes a summary of the Hawaiian land shells, and an essay by Dr. F. R. Fosberg on the "Derivation of the Flora of the Hawaiian Islands." The island plants parallel the insects in their origins, development and distribution.

The chapter on "Development of the Endemic Fauna" discusses the complex effects on speciation of repeated invasion and re-invasion of the individual islands, which will especially appeal to the student of evolution. Isolation of small populations on separate islands has resulted in the development of more species than would probably have resulted had the islands been joined in a single land mass. Not only well-reasoned and lucid, but at the same time highly readable, is the author's presentation of such topics as flightlessness, independent origins and developments, predacity and parasitism in the aboriginal fauna, centers of development and rate of evolution, and extinction of species in modern times. Mr. Zimmerman's "Introduction" is one of the most comprehensive and searching treatments of the problems of evolution under island conditions ever presented.

The taxonomic volumes contain a wealth of identification keys. They are profusely illustrated with at least one representative figure of each genus, and include numerous drawings by such superb entomological artists as Dr. Ferris, Mrs. Abernathy and Arthur Smith. The illustrations set a high standard of excellence, and leave little to be desired. Every student of Hawaiian entomology will want to have these indispensable volumes in his working library.

## Recent Changes in the Parasite Complex of Armyworms

By FRED A. BIANCHI

*(Presented at the meeting of May 10, 1948)*

It is a matter of repeated observation in the field of entomology that the most common and obvious phenomena fail to be recorded. As these are often *ipso facto* phenomena of the greatest biological and economic interest, neglecting them may easily result in confusion or unnecessary work for future entomologists. To prevent such an occurrence in connection with one of the Territory's oldest and most important problems, certain changes in the parasite complex of armyworms are here recorded.

These changes have been observed only on the island of Hawaii, where they appeared in connection with a fairly severe infestation of *Laphygma exempta* (Walker) during the first four months of 1948, but it is probable that they have also taken place on other islands. They involve the apparent elimination from the complex of some parasites of earlier introduction and their substitution by two braconids, *Apanteles marginiventris* Cresson and *Meteorus laphygmae* Viereck, introduced from Texas in 1943, and the self-introduced immigrant tachinid, *Eucelatoria armigera* (Coquillett), which was first discovered on Oahu in 1942. These three species, to judge from their relative abundance, now rank in the complex in the order given, and their effectiveness far exceeds that of all the other larval and pupal parasites combined. Whether their effectiveness is also greater than that of the two egg parasites *Trichogramma minutum* Riley and *Telenomus nawai* Ashmead is not shown by our observations but appears possible.

The principal older established larval and pupal parasites, judging again by their abundance in the cane fields of the "Big Island" during the early part of 1948, now rank as follows: *Hyposoter exiguae* (Viereck), *Chaetogaedia monticola* (Bigot), *Frontina archippivora* Williston, *Archytas cirphis* Curran, and *Euplectrus platyhypenae* Howard. *Hyposoter, Chaetogaedia,* and *Frontina* are fairly common everywhere. *Archytas* is scarce everywhere but, as has always been the case, is still more easily found in the region of Kapoho than elsewhere. *Euplectrus,* which formerly ranked first or second in the complex, is now so scarce that only a single instance of its work has been observed by the writer this year.

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# New Thrips Records and Species from the Marianas

By F. A. BIANCHI

*(Presented at the meeting of July 12, 1948)*

An interesting new tubuliferan thrips from Guam is described in this paper, and several new distributional records are given for the Marianas of terebrantian species which are, or may become, of economic importance. I am grateful to N. L. H. Krauss and F. C. Hadden for the material upon which most of these records are based, all of which is now deposited in the collection of the H.S.P.A. Experiment Station, Honolulu.

## Suborder TEREBRANTIA

### Family THRIPIDAE

**Thrips leucaenae** Moulton

Described from Guam and known hitherto from nowhere else. Collected at Susupe, Saipan, by N. L. H. Krauss, April 1, 1946.

**Thrips tabaci** Lindeman

To my knowledge, unrecorded hitherto from the Marianas. Found by F. C. Hadden on onion plants, on Tinian, March, 9, 1946.

**Thrips panicus** Moulton

Unrecorded hitherto from the Marianas. Collected by F. A. Bianchi at the airport, Guam, January 2, 1947, on grass.

**Taeniothrips setipennis** (Karny)

Known in the Marianas only from Guam. Collected by N. L. H. Krauss at Susupe, Saipan, April 1, 1946.

**Frankliniella sulphurea** Schmutz

Hitherto unrecorded from the Marianas. Collected by F. C. Hadden on pepper plants at Tinian, February 21, 1946; and by N. L. H. Krauss at Susupe, Saipan, April 11 of the same year. Mr. Krauss has also given me material of this species which he collected on Johnston Island, May 1, 1946.

## Suborder TUBULIFERA

### Family PHLAEOTHRIPIDAE

### Subfamily PHLAEOTHRIPINAE

**Haplothrips gowdeyi** (Franklin)

This cosmopolitan species has been recorded previously only from Guam. F. C. Hadden found it on Tinian, February 21, 1946; and N. L. H. Krauss in Susupe, Saipan, April 26, 1946.

**Hoplothrips fungosus** Moulton (Plate VIII; figs. A-D)

This interesting little species was described from Formosa (Trans. Nat. Hist. Soc. Formosa, **18**: 305, 1928) and has not been reported elsewhere up to now. In April 1946 Mr. Noel Krauss collected six females and two males—host unreported—at Talofofo, Guam, and kindly gave me the entire lot. Unaware that the species was already known, I had prepared an illustrated description of it when Dudley Moulton helped me determine its true identity, during a visit which I paid him in August 1948. I now append to this paper the illustrations which were to accompany my description of the species as a new one.

**Symphiothrips alifanensis** sp. nov. (Plate VIII; figs. E-G)

Male holotype (apterous): Body length 1.79 mm. Color by transmitted light: head, thorax, hind and middle tibiae, first two abdominal segments brown; abdominal segments 3 to 10 nearly black; fore-legs uniformly yellowish brown; hind and middle femora yellowish brown, lighter distally; all tarsi light except for distal macula. Sub-hypodermal pigment bright red, abundant on thorax and head. Antennal segment 1 pale yellow; 2 light brownish yellow; 3 slightly darker than 2, except in basal third which is like 2; 4 intermediate between 3 and 5, 6, 7 which are uniformly dark brown.

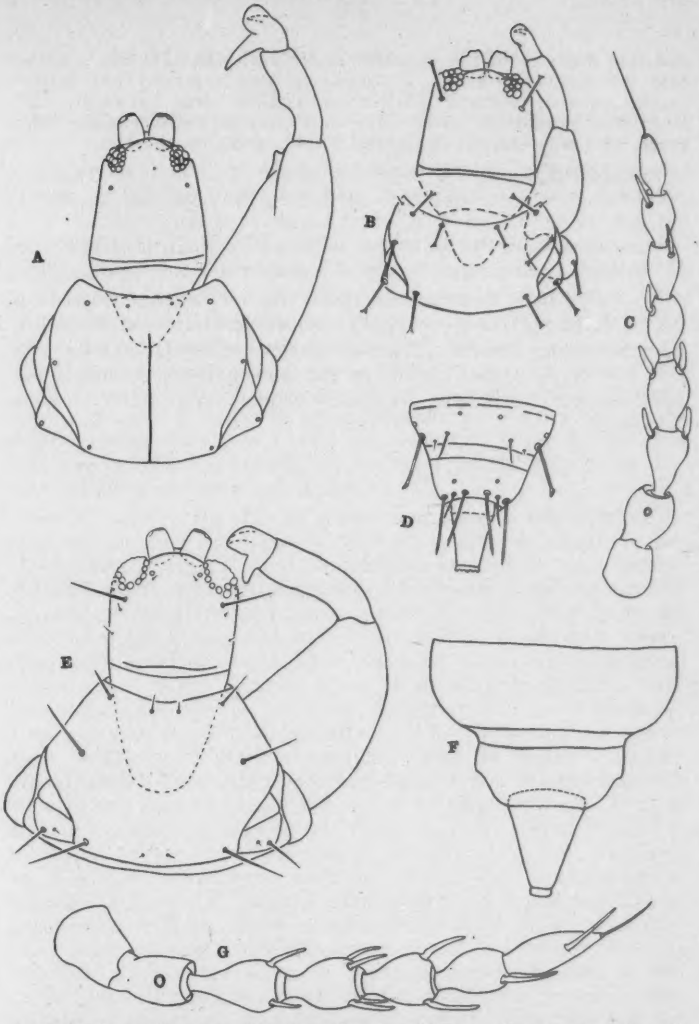
Head a little wider than long, with cheeks and vertex weakly arched. Cheeks with only one or two very fine hairs. Eyes small, rounded dorsally and ventrally, finely faceted except for a few large facets dorso-caudally. Ocelli vestigial, the posterior pair near to the inner margins of the eyes, the anterior one not discernible. Postocular spines somewhat longer than eyes and inserted about a third of their length from the cheeks, about half that distance from the eyes. Mouth cone large, reaching beyond middle of prosternum and broadly rounded at end; labrum attaining, but not surpassing labium; maxillary palpi long and thick.

Antennae more than twice as long as head, inserted under vertex, shaped as illustrated; inter-antennal costa barely surpassing vertex, weakly concave at end and much narrower than basal antennal segments. Segment 7 with an incomplete, oblique suture visible ventrally near middle of segment. Sense cones relatively long and thin: 2 on segment 3; 4 on segment 4; 2 on segment 5; 1 long thin one on inner distal angle of segment 6; 1 dorsally on segment 7.

Pronotum with fore and hind margin weakly arched; sides strongly divergent to about middle and thence nearly parallel to hind angles; mid-dorsal suture not apparent; paired setae at posterior angles and midlaterals nearly equal; antero-angulars smaller; antero-marginals minute; coxals long and stiff; all setae brownish yellow. Forelegs very powerful, with the femur as wide or wider than head and a powerful spur on basal segment of tarsus. Hind and middle legs normal, with hind ones noticeably longer.

Abdomen as wide as thorax to middle of segment 7, thence roundly narrowed to base of 8 whose sides are also rounded; sides of 9 parallel in basal half, forming a distinct angle in the middle, thence sharply convergent to base of tube. Tube typical of genus, wide at base, sharply reduced to narrow end, very heavily chitinized, asperate, minutely setigerous. Terminal setae very weak and short, not much longer than terminal width of tube. Dorsolaterals on segment 9 nearly as long as tube. Other setae of abdomen also long, pointed.

Measurements of holotype in mm.: Head length .143; head width .164; prothorax length .205; prothorax width including coxae .445; width of femur




A. **Hoplothrips fungosus** Moulton: head, prothorax, foreleg of male; all setae omitted.
B. **Hoplothrips fungosus** Moulton: head, prothorax, foreleg of female, with major setae.
C. **Hoplothrips fungosus** Moulton: dorsal view of left antenna of female; setae omitted.
D. **Hoplothrips fungosus** Moulton: dorsal view of 8th, 9th, 10th abdominal segments of female.
E. **Symphiothrips alifanensis** sp. nov.: head, prothorax, foreleg of male.
F. **Symphiothrips alifanensis** sp. nov.: 8th, 9th, 10th abdominal segments of male, all setae omitted.
G. **Symphiothrips alifanensis** sp. nov.: left antenna of male, dorsal view, setae omitted.

.143; eye width and length (approx.) .041; tube length .131; tube width at base .094; tube width at end .032; postocular setae (approx.) .049; antero-angular setae on prothorax .036; antero marginals .020; midlaterals .053; inner setae on posterior angles .057; outer setae on posterior angles .041; coxals .041; dorso-laterals on segment 9, .102; distals on tube .036.

| Antennal segments | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|---|---|---|---|---|---|---|---|---|
| | .041 | .041 | .057 | .045 | .045 | .045 | .061 | .335 |

Described from the holotype, collected by N. L. H. Krauss on Mt. Alifan, Guam, April 1, 1946. Named after the type locality.

To judge from descriptions alone, this new species must be a near relative of the genotype *S. punctatus* Hood and Williams, described from Florida. The two species are similar in habit and size but in *punctatus* coloration and antennal measurements are different, the major setae are mostly capitate, and the mouth cone is pointed.

# Dacus dorsalis Hendel, in Hawaii

By D. T. FULLAWAY

*(Presidential address, presented at the meeting of December 13, 1948)*

Since the discovery of the oriental fruitfly, *Dacus dorsalis* Hendel, in Hawaii, in May of 1946, it has received more attention from entomologists here than any other insect. A great deal of information has been collected in regard to the fly's identity, geographic range and distribution, life-history, habits, hosts (ecology), control, both artificial and biological, economic importance, etc: This information I have collected and put into form for publication as a report of the work that has been the main occupation of myself and associates during the past year or two. In view of the great interest displayed in the matter by the public and profession alike, I thought it might be an appropriate subject for the presidential address this year. I am not, however, going to tire you with the full details, but will give you as briefly as possible the essential facts related in the report.

*Identity of the fly.* It was apparent at once on examination of prepared specimens that the fly belonged to what is known as the "*ferrugineus* complex" and fortunately we had in our library Shiraki's work on the fruit insects of Formosa containing a brief account of *Dacus ferrugineus* var. *dorsalis* with illustrations in color from which we could, to our own satisfaction at least, determine the identity of our invader. Later on it was desired to have confirmation of our determination by a recognized expert and specimens were sent to Dr. Alan Stone of the U. S. National Museum, who verified the identification by comparing the specimens sent in with material obtained from the Berlin Museum where Sauter's Formosan insect collections repose. It is not believed there is any question at present about the identity of the fly that is doing so much damage to our fruits, but it is still an unsettled point whether the species or variety *dorsalis*, which was described by Hendel from specimens collected in Formosa, is extensive or restricted in range. If *dorsalis* is considered as a component of the *ferrugineus* complex, there is no question about it or its closely allied forms ranging from India in the west to Australia in the east, and from Java in the south to Formosa or even Kyushu in the north. Bezzi in his monograph on the Philippine trypetids lists *dorsalis* as occurring in a number of oriental countries but we have been unable to identify it positively in the collections from the Orient we have had. The question is more or less academic for the present.

While the presence of *dorsalis* in Hawaii was not recognized until May 10th, 1946, there seems to be no question about its having been here unrecognized more than a year previous to that date. O. C. McBride has stated that he found one female specimen of *dorsalis*

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amongst 22,500 flies reared or collected between April and July 1945, and in view of the fact that the fly has been known to be on Saipan for a decade or more, and that our armed forces returned to Hawaii after the conquest of this island, circumstantial evidence points to their being responsible for transporting the insect to our shores, probably in infested fruits.

*Life history.* There is nothing unusual in this fly's development. In cage rearings in our laboratory a period of 16 days was required for development from deposition of the egg to emergence of the adult fly, in bananas; 23 days for similar development in papaya, both records made in the summer months when development is expected to be fastest. Duration of the different stages, in the spring months, averaged less than 2 days for the egg, 16 days for the larvae, 9 days for the pupae, but in one rearing, larval development was completed in 9 days. This stage shows greatest variation, and apparently under some conditions can be greatly prolonged. We found the length of life of the adult fly unpredictable but as a general rule flies can be maintained alive much longer when properly fed and cared for. In one experiment begun with 50 females and 50 males, all fed on papaya juice diluted with water and sweetened with honey, highest mortality occurred in the third week of the experiment; one individual, a female, lived through 86 days. We have found the preoviposition period to range from 8 to 16 days, although another investigator states that 29 to 32 days (in Sept. and Oct.) and 34 to 39 days (in May and June) were required to mature the eggs. One worker has recorded observing mating an hour after darkness had set in, 22 days after the emergence of the flies. In an experiment begun with gravid females to check on oviposition habits and capacity we observed that even with ripe fruits the fly carefully explored the surface for soft spots where the ovipositor could be inserted readily, and advantage was taken of bruises, cracks and very thin areas of the skin. Where there was internal pressure to oviposit, eggs often to the number of several hundreds were laid at one time but ordinarily the number was limited to less than 10. Another investigator states that working with flies individually confined the highest daily total obtained was 37 eggs and the highest 7-day total for an individual fly was 101 eggs. Where in nature a larger number of eggs is found in one pocket or break in the skin of the fruit, it is realized it may be the deposit of several females. Early in our experience with this fly it was discovered that citronella oil exerts a decided attraction for the male flies. This peculiar quality of the oil has little significance in control operations and except to help judge the effectiveness of poison sprays in reducing fly populations in a given locality or estimating size of populations the oil has little practical use. It should be mentioned here that examination of thousands of reared specimens of the fly showed that males and females maintained about even numbers in the count. Flies trapped with citronella oil, being overwhelmingly males, presumably represent only about half the population. Another experiment planned

to obtain a check on the percentage of flies successfully passing through developmental stages on the basis of host fruit in which development took place, gave such varying results—from 37 per cent for *Opuntia* fruits to 99 per cent for papayas—that little significance is seen in the results obtained.

Many of the observations made by Koidsumi and Shibata in their ecological studies of the fly in Formosa have been verified here and I believe it is worth while to include here some of their findings as given in the review of their work which appeared in the Review of Applied Entomology. They found the adult flies more active than those of *D. cucurbitae* and believed it necessary to provide more space for them to move in when observing their habits. Emergence of the flies was observed to occur generally before noon and they believed the flies to be most active at 77-86° F., becoming dormant when the temperature dropped below 68° F. They found the flies lived about a week, without ovipositing, when given water only, and for a month when fed on honey. They lived much longer and laid eggs when fed on banana and other fruits. Oviposition began 20 days after emergence in summer, 25-60 days in autumn and 100 in winter, when the flies were fed on orange juice. Females that were about to oviposit drove away others from the fruits. According to these observers *dorsalis* females lay fewer eggs in a fruit than *cucurbitae,* only 20-30 larvae being usually found even in a large fruit as compared with 200-300 of the latter species, a single egg cavity generally containing 5 to 10 eggs. The number of eggs laid by a single female is usually 500 and sometimes 1000. Even citrus fruits that are strongly acid (pH 2.2-2.7) were sometimes attacked and larvae were able to mature in them. Flies in captivity laid eggs in ripened papaya, bruised pineapple, banana, pear, apple and persimmon and the larvae matured in all except the last two, although they are not usually attacked in the field. Captive flies laid eggs in lemon but the eggs or newly hatched larvae succumbed in the unfavorable environment. In the northern part of Formosa the flies remained dormant in winter. Though emergence from the pupae was observed to take place, eggs and larvae did not develop.

One of the most striking evidences of *dorsalis*' superlatively aggressive qualities is the gradual disappearance of the Mediterranean fruitfly *Ceratitis capitata* (Wied.). In regions like the Honolulu city area where fruit-bearing trees are everywhere present and *dorsalis* populations high, *C. capitata* has totally disappeared. This is not a notion; one has only to consult the year's record of rearings from fruit collected in Honolulu to see how nearly accurate this statement is.

Much time has been spent in collecting host fruit records for *dorsalis*. The list far surpasses in length the list of *C. capitata* hosts. Ninety-three fruits are now listed and most of the common fruits of the islands are included. The cucurbit fruits are notice-

ably absent and the common assertion that the fly shows no selectivity is not entirely true. Reference has been made earlier to a record of rearings of flies from various fruits. This record covers more than a year's study (reported on monthly) of the number of flies reared from 44 different fruits and data can be obtained from it on the number of flies per fruit and the number per pound in any month of the year when this fruit was available in a condition to become infested. Of course most of the records pertain to the four or five commercial fruits (mango, avocado, papaya, banana, fig) and to several wild fruits which are extremely common (guava, kamani and *Eugenia* spp.). It is believed that by and large the heaviest fruit production occurs in the summer months and one of the commonest fruits at this time is the mango. *Dorsalis* has ruined the mango crop for several years and in view of the great number of seedling trees everywhere the fly will surely continue to build up large populations every summer. It was very noticeable in the past summer how decidedly the fly population dropped when the mango fruit season was over. There are some data in this record showing a positive relationship between the size of the fruit and the number of flies produced but it is not consistently evident throughout, mainly because of other factors entering into consideration. The record will be particularly valuable when parasites and predators introduced to control the fly begin to have an effect on the size of the populations. Fortunately for the success of the biological control project there are some fruits both wild and cultivated that mature regularly in the fall and winter months and some that have early and late fruiting varieties and some of the most useful fruits for the propagation of the parasites often bear several crops during the year according to the vagaries of weather conditions and also where irrigation is practiced. My observation is that fruits must be approaching maturity before oviposition succeeds in it. No doubt attempts are made by flies heavy with eggs to oviposit in immature and green fruits but if the fruit is hard the skin cannot be readily penetrated; if ripening has not begun the eggs will be expelled, or crushed, or drowned in the sap, or vitiated by some deleterious agent such as a protolytic enzyme.

*Economic importance of the fly.* Although the oriental fruit-fly attacks so many fruits it is easier to name the ones it is not reared from than those it is, the economic importance of the fly is posited in its destructiveness to the commoner marketable fruits, such as the mango, avocado, banana, papaya and fig, and its menace to fruit growers in California and the American states of the Gulf Coast, where citrus fruits, a favored host in Formosa, are the big item in fruit production. Fortunately, it does not normally attack the pineapple, the one fruit of really great economic importance in Hawaii—60 million dollars yearly—(it has been reared from overripe pineapple both here and in Formosa). Export of fresh fruit, even pineapples and bananas which previous to 1940 were shipped to the west coast of America in considerable volume,

is now prohibited by federal quarantines unless the fruit is treated in such a way that all developmental stages of the fly—eggs, larvae, pupae—are killed, an expensive procedure seriously limiting its application. Besides the spoilage in edible fruit caused by injury to it by the fly in depositing its eggs and the worms developing therefrom in feeding on the pulp—a loss which can be great in tropical and semitropical climes with a fly of *dorsalis*' potentialities —injury has also been observed to the blooms of orchids and gingers which emit fragrant odors, attracting the male flies of *D. dorsalis*. The injury is in the nature of a spotting which results from tissue destruction beneath droplets of regurgitated liquid food dried too rapidly by the sun, and affecting adversely the saleability of the flowers.

*Measures taken to control the fly. Mechanical.* Bagging fruit to prevent access to it by the ovipositing female, is a very practical measure but it has its limitations. Mangoes, avocadoes and figs can usually be covered with bags and even tomatoes and other small fruits are similarly protected. Trapping has generally given poor results, as a good bait or lure has yet to be found.

*Chemical.* It has been found by experiment that wettable DDT spray gives protection to ripening fruit for at least one week. This is considered much safer than the old Mally formula of arsenic, molasses and water.

Many of the control measures found suitable in other fruit growing countries appear to be inapplicable here mainly on account of the abundance of wild fruits present, often growing in inaccessible places, which keep the fly population going in spite of any repressive measures taken. For instance, clean culture; this familiar procedure was given a trial when the Mediterranean fruitfly appeared in Hawaii in 1910-11 but proved ineffectual. With its failure recourse was had to biological control.

*Biological control.* Considerable was already known about fruit fly parasites and predators in the Orient from previous exploration there, and in numerous consignments of fruitfly material from the Philippines and Malaya three opiine parasites and one tetrastichine parasite have been generally reared. These are *Opius longicaudatus* (Ashmead), *O. persulcatus* (Silvestri), *O. incisi* Silvestri and *Syntomosphyrum indicum* Silvestri. The first named has been successfully propagated and many thousands liberated on the principal islands. Its recovery from the field has been effected in many instances on Oahu and its establishment is well nigh certain. The others have all been reared in *dorsalis* larvae but have not reproduced very well. Predators are also being introduced, particularly staphylinid beetles (one is being propagated and liberated from time to time). It is believed that eventually an effective control of the fruitfly will be obtained by the various means above detailed.

# Identity of the Anagyrus that Parasitizes the Pineapple Mealybug (Hymenoptera: Chalcidoidea: Encyrtidae)

By A. B. GAHAN

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture

*(Presented by Dr. Carter at the meeting of August 9, 1948)*

In 1936, I received from D. T. Fullaway three specimens of an *Anagyrus* which he had reared from the pineapple mealybug, *Pseudococcus brevipes* (Ckll.) collected in Brazil. I identified the parasite as probably *Anagyrus coccidivorus* Dozier, and under this name its successful introduction into Hawaii and attempts to introduce it into Puerto Rico have been recorded in the literature.

*Anagyrus coccidivorus* Dozier (Proc. Ent. Soc. Wash., **34**: 8, 1932) was described from Haiti as a parasite of *Ferrisia virgatus* (Ckll.). Biological studies by D. W. Clancy and H. N. Pollard (1947) indicate that the *Anagyrus* from *P. brevipes* will not reproduce upon *F. virgatus* and, hence, that it is probably not *A. coccidivorus*. A recomparison of specimens of the pineapple mealybug parasite with the type of *coccidivorus* shows certain slight differences which were not considered significant at the time of the first comparison, but which now appear to be constant for a long series of specimens and to confirm the conviction that this parasite is not *coccidivorus*. Since it does not appear to agree completely with any known species, it is herewith described as new.

**Anagyrus ananatis,** new species.

*Anagyrus* sp. Compere, Hawaii. Ent. Soc. Proc., **9**: 171, 1936; Carter, idem: 366, 1937.

*Anagyrus coccidivorus* Dozier (Misidentification of). Carter, Jour. Econ. Ent., **30**: 370, 1937; Hawaii. Ent. Soc., Proc. **10**: 3, 1938; **12**: 489, 1946.—Schmidt, Hawaii. Ent. Soc., Proc. **10**: 194, 1939.—Plank, Puerto Rico Agr. Expt. Sta. Rpt., for 1937, p. 98, 1938; for 1938, p. 107, 1939.—Bartlett, Puerto Rico Univ. Jour. Agr., **23**: 70, 1939.—Swezey *et al.*, Hawaii. Ent. Soc., Proc. **10**: 352, 1939.—Anonymous, Puerto Rico Agr. Expt. Sta. Rpt. for 1939, p. 109, 1940; for 1940, p. 69, 1942.—Clancy and Pollard, Jour. Econ. Ent. **40**: 579, 1947.

Belongs to the group of species having the entire flagellum, with the exception of the first funicular segment, white. Many species of the genus fall in this group, but in the majority of these the entire first funicular segment is black, whereas in this new species only the basal half or less of the first segment is black. This character,

together with the absence of any pale longitudinal streak on the inner side of the scape, will distinguish it from *coccidivorus* Dozier, with which species it otherwise agrees very closely.

*Female*—Length 1.8 mm. General color orange-yellow more or less strongly diluted with blackish. Fronto-vertex and face for the most part bright orange; posterior margins of temples and cheeks black or blackish; occiput mostly black, but with a marginal border above and at sides slightly paler yellowish than the frons; mandibles dark reddish apically, the mouthparts otherwise pale yellow. Antennal scape dull black, except for a small round spot at extreme base and a broad transverse apical band of white; pedicel black at base, the apical half white; first funicular segment black basally with the apical half or two-thirds white; remainder of funicle and all of the club white; eyes grayish. Dorsum of thorax varying from bright orange with only a slight undertone of blackish, to very dark reddish brown or nearly black, the dorsal aspect of pronotum usually concolorous with mesoscutum, but occasionally somewhat more pallid; scutellum with a blackish median streak extending approximately half its length from its base; tegulae whitish basally, brownish apically, in dark specimens mostly dark brown; prepectus, metanotal sutures and middle of propodeum more or less whitish; sides of prothorax, mesopleura, metapleura and all sterna pale orange in the type, ranging to dark or dirty orange in other specimens; legs including coxae whitish, usually stained with fuscous along the dorsal and ventral margins of femora and tibiae; propodeum pale medially, black laterally; abdomen black or dark brown above, the gaster sometimes more or less orange beneath. Wings subhyaline, the venation fuscous.

Fronto-vertex about one and one-half times as long as its narrowest width, opaque; ocelli in a nearly equilateral triangle, the lateral ocelli very slightly farther from each other than from anterior ocellus; ocell-ocular line about equal to diameter of an ocellus and about equal also to the distance from ocellus to occipital margin. Mandibles bidentate, the upper tooth rounded at apex, the inner tooth much smaller, shorter and sharp. Antenna not quite so long as the body; scape not reaching level of anterior ocellus, expanded below, about twice as long as broad; pedicel about three times as long as broad at apex; first funicular segment usually a little longer than pedicel, never shorter; funicular segments beyond the first successively shortening slightly, the sixth about twice as long as thick; club distinctly 3-segmented, very slightly thicker than funicle and a little longer than two preceding segments. Eyes with short pile. Mesoscutum, axillae, and scutellum rather densely clothed with short silvery hairs, the scutellum also with three to four pairs of black bristles, the two pairs nearest apex long and subequal, the third pair from apex usually considerably shorter, and the fourth pair when present quite short and inconspicuous. Propodeum short with fine granular sculpture and clothed with short silvery hairs laterally. Abdomen about as long as head and thorax, acute at apex, finely sculptured, and clothed with short whitish hairs; ovipositor not exserted. Spur of middle tibia equal to basal segment of tarsus. Forewing extending a little beyond apex of abdomen; uniformly and rather densely ciliated, except for the hairless streak which is broadly interrupted behind the middle; stigmal vein twice as long as marginal, postmarginal very short, much shorter than stigmal.

*Male*—Length 1.0 mm. Head, thorax and abdomen dull black; prepectus white; sides of prothorax and broad band along anterior margin of mesopleura orange; tegulae white basally, blackish apically; legs including front coxae white with some fuscous stains; hind coxae black and middle pair blackish. Antennal scape white at base and apex, black medially; pedicel black, usually paler at apex; flagellum dirty whitish, except first segment which is blackish basally. Wings hyaline, venation fuscous.

Scape short, expanded beneath, about twice as long as broad; pedicel about as broad as long; flagellum of a uniform thickness, clothed with coarse blackish hairs, its first segment approximately five times as long as thick and one and a half times as long as second segment, following segments gradually diminishing in length, the sixth about twice as long as broad; club tapering slightly toward apex and a little longer than the two preceding segments. Fronto-vertex a little broader than long. Abdomen triangular, shorter than thorax.

Type locality—Rio de Janeiro, Brazil.
Type—United States National Museum No. 58832.

Described from 81 ♀s and 5 ♂s, all reared from the pineapple mealybug, *Pseudococcus brevipes* (Ckll.). The holotype female and 5 ♀ paratypes are from the type locality, reared by D. T. Fullaway in January and February, 1936; 2 ♀s are from Recife, Brazil, reared by C. T. Schmidt, January 1, 1947; 10 ♀s were reared in November 1946, as progeny of stock collected at Bahia, Brazil, by W. Carter; the allotype male, 4 ♂ paratypes, and 63 ♀ paratypes were reared from *P. brevipes* collected in the field at Lahaina, Maui, Territory of Hawaii, in December 1947, by W. Carter, and are descendants of the original importations from Brazil.

**Anagyrus dactylopii** (Howard)

*Aphycus dactylopii* Howard, Proc. U. S. Nat. Mus., **21**: 242, 1898.
*Anagyrus dactylopii* (How.) Timberlake, Univ. Calif. Pubs. Tech. Bul., **3**: 224, 1924.

This species is very similar to *ananatis*, from which it can be distinguished by the first funicular segment being distinctly shorter than the pedicel and entirely black or blackish. The other joints of the funicle are also shorter than in the new species.

**Anagyrus yuccae** (Coquillett)

*Blastothrix yuccae* Coq. West American Scientist, **7**: 44, 1890.
*Epidinocarsis subalbicornis* Girault, Psyche, **23**: 44, 1916. (New synonymy.)
*Anagyrus yuccae* (Coq.) Timberlake, Univ. Calif. Pubs., Ent. **3**: 224, 1924.
*Anagyrus subalbicornis* (Gir.) Timb. Univ. Calif. Pubs., Ent., **3**: 224, 1924.
*Anagyrus ferrisi* Compere, Univ. Calif. Pubs., Ent., **4**: 18, 1924. (New synonymy.)
*Anagyrus subalbicornis* (Gir.) Compere, Univ. Calif. Pubs., Ent., **8**: 21, 1947.

I can see no differences between the types of *Blastothrix yuccae* Coq. and *Epidinocarsis subalbicornis* Gir., both of which are in the National Museum collection. Compere suppressed his *Anagyrus ferrisi* as a synonym of *subalbicornis*, but maintained *yuccae* as a good species chiefly on the basis of Coquillett's statement that there were eight long black bristles on the apex of the scutellum. I have

carefully examined Coquillett's type specimen and find only three pairs of bristles on the scutellum, exactly as in the types of *subalbicornis* and *ferrisi*.

*A. yuccae* is extremely close to *A. bohemani* (Westwood) as represented by a single European female specimen identified by G. Mayr. This specimen appears to be a little more uniformly black on the dorsum, and I can see only two bristles at the apex of scutellum. Otherwise I cannot distinguish it. Mayr's description of *bohemani*, however, points out so much variation that I am led to suspect that he may have included more than one species in *bohemani*, and hence, do not feel certain that this specimen is correctly identified.

**Anagyrus schönherri** (Westwood)

*Encyrtus schönherri* Westwood, Philos. Mag. (3 ser) **10**: 441, 1837.

*Blastothrix schönherri* (Westw.) Mayr, Verhandl. Zool.-Bot. Gesell. Wien, **25**: 699, 1875.

*Anagyrus schönherri* (Westw.) Mercet, Fauna Iberica, p. 243, 1921.

*Anagyrus flavus* Ishii, Bul. Imp. Agr. Expt. Sta. Japan, **3** (2): 86, 1928 (New synonymy).

I can see no differences between a specimen from Germany identified by Mayr as *Blastothrix schönherri* (Westwood) and specimens from Japan reared by C. L. Marlatt from *Pulvinaria* sp., which appear to me to agree perfectly with the description of *Anagyrus flavus* Ishii. I believe *flavus* Ishii to be a synonym of *schönherri* (Westwood).

# Two New Wasps from Melanesia and Notes on a Third Recently Introduced into Hawaii (Hymenoptera: Sphecidae)

By KARL V. KROMBEIN

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture

*(Presented by Mr. Van Zwaluwenburg at the meeting of August 9, 1948)*

The new species described herein are based on material in the U. S. National Museum and loans received from the Hawaiian Sugar Planters' Association through E. C. Zimmerman and from the British Museum (Natural History) through R. B. Benson. Dr. F. X. Williams and Mr. Benson of the last two institutions respectively have very kindly compared specimens of *Pison* with species in the collections under their care.

**Pison insulare** Smith

*Pison insularis* Smith, 1869. Trans. Ent. Soc. London, p. 297. (♀; New Hebrides; type in British Museum.)—Turner, 1916. Proc. Zool. Soc. London, p. 626. (Treated as specifically distinct from *priscum* Turner.)

*Pison insulare* Smith, Dalla Torre, 1897. Cat. Hym. **8**: 711.—Turner, 1908. Proc. Zool. Soc. London, p. 510. (Comp. with *insulare priscum*, n. subsp. from Australia.)—Cheesman, 1937. Ann. Mag. Nat. Hist. (10)**20**: 203. (♀, ♂; Malekula, Espiritu Santo, Erromango, Tanna, Aneytioum, Efate and Gaoua, all islands in New Hebrides; addit. descr.).

*Pison* sp., Weber, 1948. Proc. Hawaii. Ent. Soc. **13**: 222. (Kawaiiki Trail, Koolau Mts., Oahu.)

In November 1947 P. W. Weber collected four large *Pison* females on Oahu, T. H., which were subsequently submitted to me for identification. Comparison of these specimens with material available from other islands of the Pacific established that these constituted a recent introduction from New Hebrides, being conspecific with a female from Espiritu Santo, New Hebrides, in my personal collection.

The question as to what name should be applied to this species was a puzzle. Only one *Pison, insulare* Smith, had been described from New Hebrides, but Williams (1945. Proc. Hawaii. Ent. Soc. **12**: 442) had identified as *insulare* a species from New Caledonia which was quite distinct from the New Hebridean and Hawaiian material mentioned above. Both Williams and I had considered that my specimen from New Hebrides was an undescribed species. However, when this supposed new species turned up in Hawaii late in 1947 further investigation seemed desirable. The descriptions of *insulare* by Smith and Cheesman did not definitely eliminate the New Caledonian species from consideration as true *insulare*, so I sent specimens of each species to Mr. Benson for comparison with Smith's type. He reports (in litt.) "As you suggest the form

from New Hebrides and Hawaii is the true *P. insulare* and the New Caledonian form differs from this in its much denser punctation of propodeum and first tergite." He states further that the species from New Caledonia differed from all others in the British Museum on gross punctation.

Mr. Weber (in litt.) states that the Hawaiian specimens were taken slightly north of the center of Oahu removed from any point of importation, and says further that, "... the wasps could easily have been here for some time and spread that far without being detected. A similar case in point is that of *Chalybion bengalense* which was first recorded from the southwest coast of Oahu at Nanakuli, and shortly after was observed in Manoa Valley, some thirty miles distant." Therefore, *insulare* Smith appears to be an established member of the Hawaiian fauna with the known distribution limited to various islands of the New Hebrides group and Oahu, T. H.

The comparatively large size (♀, 9.5-11 mm. long) readily distinguishes *insulare* from other *Pison* occurring in Hawaii except *hospes* Smith. It is more polished than *hospes,* comparatively much more sparsely punctate (disk of mesoscutum with punctures separated by several times the width of a puncture, middle of dorsal surface of propodeum practically impunctate), only the first two tergites have apical bands of silvery pubescence, and the median lobe of the apical margin of the clypeus in the female is broadly rounded rather than triangular.

I have examined the following material:

NEW HEBRIDES. 1 ♀ ; Espiritu Santo; September 28-October 7, 1943 (J. G. Franclemont) [KVK]. 2 ♂ ; same data, but September 1944 (K. L. Knight) [USNM]. 1 ♀ ; Malekula; January 1930 (L. E. Cheesman) [BM].

HAWAII. 2 ♀ ; Kawaiiki Trail, Oahu; November 2, 1947 (P. W. Weber). 2 ♀ ; Anahulu Trail, Oahu; November 30, 1947 (P. W. Weber) [USNM and PWW].

**Pison novocaledonica,** new species

*Pison insulare* Williams, 1945. Proc. Hawaii. Ent. Soc. **12**: 442, pl. 24, figs. E, G, H; pl. 25, fig. H. (Misident. of Smith species.)

Structurally this species comes closer to *hospes* Smith than to *insulare* Smith, agreeing with the former in the subopaque integument and relatively stronger and closer puncturation. *P. hospes* differs from *novocaledonica* in the following important particulars: Median impunctate produced area of clypeus triangular; frontal groove from anterior ocellus evanescent; transverse rugae of posterior surface of propodeum stronger and sparser; sternites much more closely punctate, especially the second; only extreme apex of wing infumated.

Type: ♂ ; St. Louis, New Caledonia; November 26, 1944 (Wilfred Crabb). (U. S. National Museum, Type No. 58814.)

*Male*—Length 9.5 mm. Black, subopaque except metapleuron, propodeum and abdominal sternites which are shining; tip of mandible dark castaneous, apex of tegula somewhat lighter. Vestiture shining, silvery, short, suberect on head and thorax, decumbent on legs and abdomen, abdominal tergites one to four with noticeable hair bands apically; tibial calcaria black. Wings with apical two-thirds of forewing and apical third of hind wing rather strongly infumated, stigma and veins fuscous.

Head: Impunctate median produced area of clypeus pentagonal in shape; shortest distance between eyes at lower ends (across middle of clypeus) greater than shortest distance between eyes on vertex (5:3); front finely granulate upon which is superimposed moderately large, shallow punctures separated from each other by slightly more than the width of a puncture, a median longitudinal groove running from anterior ocellus two-thirds of distance to antennal insertions and terminating there in a short polished streak (the vestige of frontal tubercle); vertex with punctures somewhat smaller and separated by slightly less than the diameter of a puncture; ocellocular distance half the diameter of a posterior ocellus and less than postocellar distance (5:8).

Thorax: Mesoscutum with punctures about same size as on front, mostly separated by slightly less than width of a puncture; scutellum and postscutellum with smaller punctures, those of former rather sparse in center, those on latter almost contiguous; mesopleuron with punctures somewhat larger than on mesoscutum and about equally spaced; metapleuron punctate-rugulose above and with scattered minute punctures below; dorsal surface of propodeum with a well-developed median longitudinal crenulate groove, laterad of this with punctures arranged more or less in oblique rows and with a faint indication of rugulae, the punctures about as large as on mesoscutum and many of them separated by about the width of a puncture; posterior surface transversely ruguloso-punctate, median impression on upper part moderately broad; lateral surface with subcontiguous punctures becoming somewhat denser to the rear; groove separating lateral from dorsal and posterior surfaces well-marked and extending anteriorly almost to spiracle.

Abdomen: Tergites one to five slightly constricted apically, the fifth very faintly so; puncturation slightly finer than that of postscutellum, punctures of first tergite separated by two or more times the width of a puncture, the density increasing on succeeding tergites, those on the fifth separated by less than twice the width of a puncture; sternites correspondingly much more sparsely punctate, the second with only a few scattered ones discally, laterally with closer ones, the density increasing on succeeding ones; intermediate sternites simple, not tuberculate or ridged, the third to fifth slightly constricted apically; hypopygium shallowly emarginate apically, the lateral angle short, broad, rounded, medianly near apex with a semicircular, rounded impression bordered posteriorly by the apical row of dark stout setae.

Wings: Forewing with petiole of second submarginal cell about as long as height of cell; first recurrent vein interstitial with first transverse cubital, second recurrent vein received in second submarginal cell just before tip.

Male paratypes vary in length from 7.0 to 10.5 mm. and differ from the type in the following structural details: Frontal tubercle usually higher and more elongate; occasionally the median groove on dorsal surface of propodeum bisected in part or entirely by a carina; sometimes the first recurrent is received just before the apex of first submarginal cell; and sometimes the second recurrent is interstitial with the second transverse cubital.

Allotype: ♀; same data as type. (USNM.)

*Female*—Length 8 mm. (apical abdominal segments somewhat retracted). Similar to type male except as follows: Median impunctate produced area of clypeus broadly rounded; shortest distance between eyes at lower ends (across middle of clypeus) proportionately greater as compared to shortest distance between eyes on vertex (3:2); frontal tubercle higher, more elongate;

ocellocular space one-fourth the diameter of a posterior ocellus, and one-third the postocellar distance; dorsal surface of propodeum lacking any indication of oblique rugulae; groove separating lateral from dorsal and posterior surfaces of propodeum well-marked, but not extending so far forward; only tergites one to three with noticeable apical bands of silvery hair; only first four tergites slightly constricted at apex, the sternites not constricted; second recurrent interstitial with second transverse cubital.

Female paratypes vary in length from 8.5 to 11.0 mm. and differ from the allotype in the following structural details: Median groove on dorsal surface of propodeum rarely bisected by a carina; recurrent nervures occasionally received slightly before the first and second transverse cubitals respectively.

Paratypes: 32 ♂, 30 ♀, all New Caledonia, as follows:

1 ♂, same data as type; 1 ♂, Noumea, October 6, 1944 (Wilfred Crabb); 1 ♀, same data, but December 12, 1944; 1 ♀, Plum Farm, January 3 (W. P. Cockerell) [USNM].

2 ♂ (P. D. Montague); 1 ♀, Noumea, January 20, 1914 (P. D. Montague); 1 ♀, same data, but January 24, 1914; 1 ♂, Bourail, December 1930 (L. E. Cheesman) [BM].

1 ♂, 1940 (F. X. Williams); 1 ♀, Noumea, August 18, 1940 (F. X. W.); 1 ♀, same data, but August 28, 1940; 1 ♀, same data, but September 9, 1940; 1 ♂, same data, but September 17, 1940; 1 ♀, same data, but September 23, 1940; 1 ♂, same data, but September 24, 1940; 1 ♂, same data, but October 13, 1940; 2 ♀, same data, but October 18, 1940; 1 ♂, same data, but October 19, 1940; 1 ♀, same data, but October 1940; 1 ♀, near Noumea, September 12, 1940 (F. X. W., reared from cocoon in mud cell of *Eumenes*); 2 ♂, 1 ♀, hills behind Noumea, October 16, 1940 (F. X. W.); 1 ♂, same data, but October 19, 1940; 1 ♂, 3 ♀, Hienghene, October 4, 1940 (F. X. W.); 1 ♀, same data, but October 5, 1940; 1 ♂, same data, but October 6, 1940; 2 ♂, 2 ♀, Thi River Valley, November 1, 1940 (F. X. W.); 2 ♂, 1 ♀, same data, but November 6, 1940; 2 ♀, same data, but November 8, 1940; 1 ♂, St. Louis, August 17, 1940 (F. X. W.); 1 ♀, same data, but September 25, 1940; 3 ♂, 2 ♀, same data, but October 14, 1940; 1 ♂, same data, but October 29, 1940; 2 ♂, 1 ♀, Nakety, October 9, 1940 (F. X. W.); 1 ♂, 1 ♀, Bonjou District, September 13, 1940 (F. X. W.); 1 ♂, Oua Tom, September 19, 1940 (F. X. W.); 1 ♂, same data, but September 20, 1940; 1 ♂, Prony Bay, October 22, 1940 (F. X. W.); 2 ♀, Nepoui Valley, July 1940 (F. X. W.); 2 ♂, 1 ♀, Isle of Pines, October 24, 1940 (F. X. W.) [HSPA].

Male and female paratypes also have been deposited in the collections of the California Academy of Sciences, American Museum of Natural History, and Museum of Comparative Zoology.

**Psen (Psen) cheesmanae,**[1] new species

Specimens of this undescribed species were included among some New Guinea and Solomon Islands material sent me by Mr. Benson several years ago. Since I am not including New Hebrides in my

work on the wasps of New Guinea and Solomon Islands I take this opportunity to describe the present form.

*Psen bryani* Perkins and Cheesman (1928. Ins. Samoa, Part V, Hym., Fasc. 1: 28) from Samoa is the only other true *Psen* known from the islands of the Melanesian subregion. Endemic species of this genus might be expected to occur on other large island groups of this subregion, such as Fiji and New Caledonia, but as yet none has been collected.

The present species, known only from the male, is distinguished from the male of *bryani* by the following characters: Hind tarsi testaceous (said to be almost black in *bryani*); petiole of first abdominal segment twice as long as first tergite (stated to be one and one-half times as long in *bryani*); and fasciculate hairs at apices medianly of third and fourth sternites extending about one-fifth the width of sternites (said to be one-third in *bryani*).

Type: ♂; [Espiritu] Santo, New Hebrides; August-September 1929 (L. E. Cheesman) [British Museum (Natural History)].

*Male*—Length 10 mm. Black, the tarsi testaceous; head and thorax, except metapleuron, semi-mat, metapleuron and abdomen shining. Vestiture shining, silvery, very dense on clypeus and front beneath antennae obscuring the puncturation, decumbent except on vertex, dorsum of thorax and propodeum, and longer on mesopleuron and propodeum than elsewhere; fasciculate hairs at apices of third and fourth sternites yellowish. Wings hyaline, veins fuscous, venation apparently as in *bryani*.

Head: Edge of clypeus thickened medianly, slightly emarginate there, not at all strongly produced; frontal carina terminating between antennae in a low rounded, cariniform tubercle; antenna slightly clavate toward tip, tyloides absent, pedicel not hidden in apex of scape, first flagellar segment longer than second or third, but somewhat shorter than second and third together; front above antennae with small punctures, those beneath anterior ocellus about as close to one another as the diameter of a puncture, those on vertex much sparser, usually separated by at least twice the width of a puncture; ocellocular distance very slightly less than postocellar distance (9:10).

Thorax: Pronotum not dentate laterally; mesoscutum with punctures larger than those on vertex, denser anteriorly and separated by about the diameter of a puncture, sparser posteriorly and separated usually by at least twice that distance; scutellum with punctures as on mesoscutum, but more scattered; postscutellum with minute close punctures; disk of mesopleuron with minute, extremely sparse punctures; metapleuron glabrous, impunctate, enclosure on dorsum of propodeum with about ten strong, radiating rugae, lateral surface punctate, posterior surface punctate and with large, irregular reticulations.

Abdomen: Petiole of first segment convex above, laterally with a series of sparse pale hairs, twice as long as first tergite; fasciculate yellowish hairs at apices medianly of third and fourth sternites extending over about one-fifth the width of segments.

Paratype: ♂; Malekula, New Hebrides; December 1929 (L. E. Cheesman) [BM]. Deposited in U. S. National Museum.

The paratype differs from the type in the following details: Length 11 mm.; interantennal tubercle larger; hind legs missing so coloration of tarsi of type cannot be confirmed.

[1] For Miss L. E. Cheesman, collector of many interesting Hymenoptera on the Pacific islands.

# The Aculeate Hymenoptera of Micronesia
## I. Scoliidae, Mutillidae, Pompilidae and Sphecidae

By KARL V. KROMBEIN

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture

*(Presented by Mr. Van Zwaluwenburg at the meeting of November 9, 1948)*

Prior to World War II the aculeate Hymenoptera fauna of Micronesia had received scant attention. Aside from scattered descriptions of individual species only a few papers have dealt with all the fauna of any island or group of islands. The earliest faunistic paper of any importance is the brief list of Guam Hymenoptera by D. T. Fullaway in 1913, which contains thirteen species of bees and wasps, less than half of them being determined to species. The collecting expeditions of the Japanese entomologists, T. Esaki and K. Yasumatsu formed the basis for a series of papers by the latter on the bees and wasps. The bees of the joint Bishop Museum-Japanese Government expedition to the Caroline Islands in 1936 were treated by T. D. A. Cockerell, who also contributed papers on the bees of Guam and Rota Island collected by O. H. Swezey, E. H. Bryan, Jr., and R. L. Usinger. O. H. Swezey also contributed a short paper on the wasps of Guam. A bibliography of the papers dealing with Micronesian wasps is included at the end of this paper.

It is my intention to bring together the information contained in the scattered papers referred to above, as well as to record a number of new endemic species and recently introduced species. The amount of material available for study has been considerably greater than that used by any previous investigator and comes from a wider range of islands.

In spite of this wealth of material, there are still gaps in our knowledge. Several species are known from only one sex. Probably a few endemic species have escaped collection, and undoubtedly additional species will be introduced, intentionally or accidentally. In a few cases, such as *Pison korrorense*, the material at hand has been too limited to permit a final decision as to whether the form should be accorded specific or subspecific rank. Almost nothing is known of the habits of the species discussed. Whenever any biological facts have been recorded, even though based on extralimital observations, they have been noted in the discussion of the particular species.

I have assumed that many species were introduced into Micronesia during the war years owing to the great increase in surface and air shipping during that period. This assumption is supported by positive evidence only with respect to Guam, where there was a good deal of pre-war collecting. Swezey's (1942) list of the Guam wasps included collections through 1936. It is significant that no *Sceliphron* were taken—two species are now established

on Guam, and it is known that one of them, *laetum,* accompanied a convoy from the Solomons to Guam in 1945. These are large conspicuous insects, which could not have failed to attract attention if they had been established prior to the war. Other late-comers to Guam not taken in pre-war collections are *Tachysphex bengalensis* and *Motes laboriosus.*

Without question the outstanding collection of Micronesian aculeates, considering both the number of individuals and the number of species, was that made during the economic survey of Micronesia by the U. S. Commercial Company from May to August 1946. The entomologists of this expedition, H. K. Townes and R. G. Oakley of the Bureau of Entomology and Plant Quarantine, visited about 20 islands or island groups, and collected on all important groups in Micronesia, with the exception of the northern Marianas and the Gilbert Islands. A total of about 500 bees and wasps was obtained, and the thoroughness of the field work is attested to by the fact that nearly every species previously reported was included, as well as many others, some new and some recently introduced. The number of species represented is extraordinary considering the limited time which was available on most islands.

This material has been supplemented by several smaller lots, some collected by entomologists during their military service in the Pacific, and a post-war collection made by K. L. Maehler, of the Bureau of Entomology and Plant Quarantine. The material obtained by H. S. Dybas in 1948 in the Palaus and Ponape has not been available, but it is hoped that a study of this can be included as an appendix in Part II of the present paper.

The bees will be treated in Part II, which I hope to complete during the next year. The present section treats all families of wasps known to be present in Micronesia, with the exception of the Vespidae. This family would have been included if J. C. Bequaert had not already made a great deal of progress on his projected monograph of the Vespidae of Oceania. Since duplication of effort seemed unnecessary I have turned over to Dr. Bequaert all my material in this particular family.

Keys are presented for the ready identification of the families, genera and species at present occurring in Micronesia. Any specimen which fails to agree with the characters ascribed to a particular species, either in the keys or descriptions of new species, should be viewed with some suspicion, since it may belong to endemic or introduced species not included herein.

The synonymy listed under each species includes all references to that species based on material from Micronesia. In introduced species, the original descriptions of all synonyms, where there are any, are given also, even though these references may not have been based on material from Micronesia.

All Micronesian material listed is at present in the United States National Museum, except where specified by abbreviations in brackets following the locality data. Other collections from which

material has been examined and the abbreviations used for each such collection are as follows:

Bernice P. Bishop Museum [BPB]
Hawaiian Sugar Planters' Association [HSPA]
K. V. Krombein, personal collection [KVK]
K. L. Maehler, personal collection [KLM]

Wherever possible, duplicates of each species will be deposited in the collection of the B. P. Bishop Museum, Honolulu.

Thanks are due to F. X. Williams for valuable information on Oceanic *Pison* and the donation of several specimens from the Hawaiian Sugar Planters' Association. E. C. Zimmerman and R. H. Van Zwaluwenburg have assisted by arranging the loan of specimens from the B. P. Bishop Museum and Hawaiian Sugar Planters' Association. K. Yasumatsu has kindly sent a female paratype of his *Liris esakii*.

## DISTRIBUTION OF MICRONESIAN WASPS

(An asterisk denotes an endemic or supposedly endemic species)

### SCOLIIDAE

***Campsomeris (Campsomeris) palauensis** (Turner), Carolines (Palaus)

**Campsomeris (Campsomeris) annulata** (Fabricius), Marianas (Guam, Rota, Saipan)

**Scolia (Scolia) ruficornis** Fabricius, Carolines (Palaus)

**Scolia (Triscolia) patricialis plebeja** (Gribodo), Carolines (Palaus)

### MUTILLIDAE

***Timulla** species, Carolines (Palaus)

### POMPILIDAE

**Auplopus** species, Marianas (Guam)

**Anoplius opulentus** (Smith), Marianas (Guam, Tinian, Saipan), Carolines (Palaus)

***Episyron maehleri** sp. n., Carolines (Palaus)

### VESPIDAE

The following species have been recorded from Micronesia by Bequaert and Yasumatsu, 1939 (Tenthredo **2**: 314-328, pls. 5-8), Swezey, 1942 (B. P. Bishop Mus. Bul. **172**: 186-187), Yasumatsu, 1945 (Mushi **16**: 35-45, 2 figs.), and Townes, 1946 (Rpt. **14**, U. S. Comm. Co. Surv. Micronesia, pp. 49-50), and are listed here for the sake of completeness.

**Polistes olivaceus** (DeGeer), Marianas (Guam, Rota, Saipan, Tinian)

***Polistes semiflavus** Holmgren, Marianas (Guam, Rota)

**Ropalidia marginata sundaica** van der Vecht, Marianas (Guam, Rota, Saipan, Tinian, Pagan), Carolines (Truk)

**Rygchium haemorrhoidale** var. **quinquecinctum** (Fabricius), Marianas (Guam, Rota, Saipan, Pagan)
**Pachodynerus nasidens** (Latreille), Marshalls (Kwajalein, Eniwetok, Majuro), Marianas (Guam), Carolines (Truk)
***Odynerus mariannensis** Bequaert and Yasumatsu, Marianas (Rota, Tinian [?])
***Odynerus paganensis** Yasumatsu, Marianas (Pagan)
***Odynerus saipanensis** Yasumatsu, Marianas (Saipan)
***Pseudonortonia esakii** Bequaert and Yasumatsu, Carolines (Palaus)
***Pseudonortonia palauensis** Bequaert and Yasumatsu, Carolines (Palaus)
***Pseudonortonia yapensis** Yasumatsu, Carolines (Yap)

SPHECIDAE

**Chalybion bengalense** (Dahlbom), Gilberts (Tarawa)
**Sceliphron laetum** (Smith), Marianas (Guam), Carolines, (Palaus)
**Sceliphron madraspatanum** (Fabricius), Carolines (Palaus)
**Sceliphron ceamentarium** (Drury), Marshalls (Kwajalein), Marianas (Guam, Saipan, Tinian)
***Lestica (Solenius) constricta** sp. n., Carolines (Palaus)
***Dasyproctus immaculatus** sp. n., Carolines (Palaus)
**Tachysphex bengalensis** Cameron, Marianas (Saipan), Carolines (Palaus)
**Dicranorhina** species, Carolines (Palaus)
**Motes subtesselatus** (Smith), Marshalls (Kwajalein)
**Motes laboriosus** (Smith), Marianas (Guam, Tinian, Saipan)
**Motes manilae** (Ashmead), Marianas (Guam, Saipan, Pagan), Carolines (Truk, Palaus)
***Motes townesi** sp. n., Carolines (Palaus)
**Liris opulenta** (Lepeletier), Marshalls (Kwajalein), Marianas (Guam, Tinian, Saipan, Pagan), Carolines (Truk, Palaus)
**Liris samoensis** Williams, Carolines (Ponape)
***Liris esakii** Yasumatsu, Carolines (Yap, Truk)
***Liris mindanaoensis carolinensis** Yasumatsu, Carolines (Truk)
***Liris williamsi** sp. n. Carolines (Palaus)
**Solierella rohweri** (Bridwell), Marshalls (Eniwetok)
**Trypoxylon philippinense** Ashmead, Marianas (Guam)
**Pison punctifrons** Shuckard, Marshalls (Enitewok), Marianas (Guam, Tinian, Saipan, Agrihan), Carolines (Kapingamarangi, Yap, Palaus)
***Pison esakii** Yasumatsu, Marianas (Guam, Rota, Tinian)
***Pison nigellum** sp. n., Carolines (Ponape)
**Pison argentatum** Shuckard, Marianas (Guam), Carolines (Ponape, Truk)
**Pison ignavum** Turner, Carolines (Palaus)
**Pison hospes** Smith, Marshalls (Ailinglapalap, Jaluit), Carolines (Palaus)
**Pison tahitense** Saussure, Marshalls (Ailinglapalap)

***Pison ponape** sp. n., Carolines (Ponape)

***Pison oakleyi** sp. n., Marianas (Guam, Rota)

**Pison iridipenne** Smith, Marshalls (Ailinglapalap), Marianas (Tinian), Carolines (Kusaie, Ponape, Truk, Palaus)

***Pison korrorense** Yasumatsu, Carolines (Palaus)

It is of interest to note that only the high islands have developed endemic species. The low coral atolls have only a sparse, introduced fauna derived mainly from the Oriental region. Comparatively few of the introduced species on any of the islands reached there from the east. The complete distribution of the introduced species is considered in the discussion of each such species.

KEY TO THE FAMILIES OF MICRONESIAN ACULEATES[1]

1. Pronotum reaching the tegulae, or the latter lacking entirely (a wingless female) ..... 2

   Pronotum not reaching the tegulae, lateral surface with a rounded lobe covering spiracle ..... 5

2. Second abdominal tergite with a narrow longitudinal band of dense appressed hairs (the "felt" line) near side; female wingless, the thorax a chitinous box, movable sutures lacking; hind wing of male without anal lobe ..... **Mutillidae**

   Second tergite without such a "felt" line; females always winged, and hind wing in both sexes with an anal lobe.. 3

3. Apical third of wings lacking veins, the membrane striolate; femora and tibiae of females enlarged, fossorial, outer surface of tibiae with numerous close-set thorns ..... **Scoliidae**

   Apical third of wings with veins in at least part of the area, the membrane not striolate; femora and tibiae of females not enlarged, the latter without numerous thorns ..... 4

4. Forewing longitudinally folded when at rest; inner margin of eye deeply emarginate, the eye reniform in outline ..... **Vespidae**[2]

   Forewing not longitudinally folded; inner margin of eye straight or only very slightly emarginate, not reniform in outline ..... **Pompilidae**

5. None of body hairs branched or plumose, females without pollen-collecting apparatus; posterior basitarsus normally slender, not flattened nor broader than following segments ..... **Sphecidae**

[1] Antennae 12-segmented in female, 13-segmented in male (12-segmented in one species, which has fore and mid tarsi strongly flattened and only one submarginal cell in forewing); abdomen with six visible segments in female, and usually seven in male.

[2] This family is not treated further in the present work.

At least some of body hairs branched or plumose, females usually with a specialized pollen-collecting apparatus, a scopa or corbiculum; posterior basitarsus usually flattened and broader than following segments.....
.....**Colletidae, Halictidae, Megachilidae,** and **Apidae**[3]

FAMILY SCOLIIDAE

The only endemic scoliid in this area is *Campsomeris* (*Campsomeris*) *palauensis* (Turner) of the Palau Islands. Several years ago *Campsomeris* (*Campsomeris*) *annulata* (Fabricius) was liberated on Guam, Saipan and Rota Islands in the Marianas, where it is now very common and apparently an important factor in the reduction of *Anomala sulcatula* Burmeister. In 1948 two other scoliids were liberated on the Palaus for control of the rhinoceros beetle, *Oryctes rhinoceros* (Linnaeus), namely *Scolia* (*Triscolia*) *patricialis plebeja* (Gribodo) from Malaya and *Scolia* (*Scolia*) *ruficornis* Fabricius from Africa.

The four species may be separated by the following key:

1. Forewing with two complete recurrent nervures, both received by the second submarginal cell (only two submarginal cells); mesopleuron sloping gradually from beneath wing base, without a distinct dorsal surface; sexual dimorphism marked, the male very slender *Campsomeris* ..... 2

Forewing with only one complete recurrent nervure, this received by the second submarginal cell (two or three submarginal cells); mesopleuron with a shoulder beneath wing base having a distinct dorsal surface; sexual dimorphism not greatly developed, the male stocky *Scolia* ..... 3

2. ♀ ♀ : Integument entirely black, the abdominal tergites with conspicuous apical fringes of thick, pale hair; occiput, pronotum laterally, and median area of dorsal surface of propodeum with dense, conspicuous, erect white hair; wings hyaline, slightly infumated on basal two-thirds, deeply so on apical third. ♂ ♂ : Last two abdominal segments entirely black and with black pubescence; clypeus laterally yellow, the mesopleuron and lateral surface of propodeum without pale maculations; legs black with outer surface of fore and mid femora at tip, and fore and mid tibiae entirely yellow; short, dense, decumbent pubescence of thorax silvery; Marianas .....
**Campsomeris (Campsomeris) annulata** (Fabricius) (p. 374)

♀ ♀ : Head between compound eye and ocelli, pronotum, and abdominal tergites one to four with yellow markings, the latter with sparse apical fringes of orange

[3] A key for these families of bees will be given in Part II of the present work.

hairs; occiput, pronotum laterally and median area of dorsal surface of propodeum with the erect hairs sparse, tinged with ferruginous; wings hyaline, uniformly infumated with yellowish. ♂ ♂ : Last three abdominal segments ferruginous and with ferruginous pubescence; clypeus entirely, mesopleuron and lateral surface of propodeum extensively, yellow; legs ferruginous, much more extensively marked with yellow; short, dense, decumbent pubescence of thorax golden; Carolines (Palaus) .....
**Campsomeris (Campsomeris) palauensis** (Turner) (p. 373)

3. Forewing with two submarginal cells, very dark brown; dorsum of first tergite with a basal tubercle; hair of thorax and abdomen black, sparse and short; antennae orange; abdomen entirely black; Carolines (Palaus) .....**Scolia (Scolia) ruficornis** Fabricius (p. 375)

Forewing with three submarginal cells, lighter brown; dorsum of first tergite not tuberculate; hair of thorax (except mesoscutum and scutellum) and abdomen black, dense and long; antennae black; third tergite of abdomen with a pair of yellow maculations; Carolines (Palaus) .....
....**Scolia (Triscolia) patricialis plebeja** (Gribodo) (p. 375)

**Campsomeris (Campsomeris) palauensis** (Turner)

*Scolia* (*Dielis*) *palauensis* Turner, 1911. Ann. Mag. Nat. Hist. (8) **7**: 308; [ ♀ , ♂ ; Palaus; type in Deutsch Ent. Inst., Berlin].

*Campsomeris* (*Dielis*) *palauensis* (Turner) Betrem, 1928. Treubia, Suppl. vol. **9**: 92.

*Campsomeris palauensis* (Turner) Uchida, 1933. Jour. Faculty Agr. Hokkaido Imp. Univ. **32**: 257, pl. 2, fig. 15 [ ♀ ].—Bequaert and Yasumatsu, 1939. Tenthredo **2**: 327.—Townes, 1946. Rpt. **14**, U. S. Comm. Co. Surv. Micronesia, p. 48.

*Campsomeris palauensis* form *uchiyamai* Uchida, 1933. Jour. Faculty Agr. Hokkaido Imp. Univ. **32**: 257, pl. 2, fig. 14 [ ♂ ; Palaus; type in Sapporo, Hokkaido, Japan]. New synonym.

The extensive yellow maculations in both sexes and ferruginous apical segments of the male abdomen readily distinguish this sole endemic species from introduced species of Scoliidae.

Uchida's form *uchiyamai* seems to have been based on the typical male, as most specimens before me agree with his brief notes. The only respects in which Uchida's form differs from the descriptions by Turner and Betrem are that the antennae are dark brown beneath (Turner and Betrêm mention only that the scape is yellow beneath—all my males have in addition the flagellum brownish beneath), and that there are two spots on the median dorsal area of the propodeum (there is variation in my specimens from those

with no markings to those with all intervening gradations of yellow markings).

I have examined the following material:

CAROLINE ISLANDS: 4 ♀ ♀, 24 ♂ ♂; Arakabesan Island, Palaus; July 18, 1946 (H. K. Townes; on roadside vegetation). 3 ♂ ♂; northeast cornor of Koror Island, Palaus; July 22, 1946 (H. K. Townes). 1 ♂; Koror Island; March 15-25, 1948 (K. L. Maehler; in forest visiting flowers). 1 ♂; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes). 3 ♀ ♀, 1 ♂; Peleliu Island; 1945 (C. K. Dorsey).

**Campsomeris (Campsomeris) annulata** (Fabricius)

*Tiphia annulata* Fabricius, 1793. Ent. syst. **2**: 225 [♀; China; type in Kiel (?)].

*Campsomeris Servillii* Lepeletier, 1845. Hist. nat. ins. Hym. **3**: 501 [♀; Java; type in Paris (?)].

*Campsomeris* (*Dielis*) *annulata* (Fabricius) Betrem, 1928. Treubia, Suppl. vol. **9**: 94, pl. 2, fig. 11 [♀, ♂; redescription and distributional notes].

*Campsomeris annulata* (Fabricius) Townes, 1946. Rpt. **14**, U. S. Comm. Co. Surv. Micronesia, p. 48 [common in southern Marianas].

This species has a wide distribution in Japan, Korea, China, India and the East Indies. In Korea it is parasitic on several species of *Anomala* and *Popillia* larvae. Efforts to establish it in eastern North America in 1925 and 1926 for control of *Popillia japonica* Newman were unsuccessful. It is now extremely abundant in the southern Marianas and appears to be a potent factor in reduction of the *Anomala sulcatula* population.

I have examined the following material from Micronesia:

MARIANA ISLANDS: 2 ♀ ♀, 3 ♂ ♂; Point Ritidian, Guam; June 1945 (J. L. Gressitt). 3 ♂ ♂; same data, but March 7, 1948 (K. L. Maehler; on *Ipomoea pes-caprae*). 1 ♂; Mount Santa Rosa, Guam; June 1945 (J. L. Gressitt and G. E. Bohart). 1 ♂; Yigo, Guam; March 9, 1948 (K. L. Maehler). 1 ♀, 1 ♂; Dededo, Guam; December 24, 1947 (K. L. Maehler). 1 ♀, 1 ♂; Point Oca, Guam; May 1945 (J. L. Gressitt and G. E. Bohart). 1 ♂; same data, but December 20, 1945 (J. L. Gressitt; at light). 1 ♂; Ukudu, Guam; January 3, 1945 (J. L. Gressitt and G. E. Bohart). 1 ♀; Haputo Point, Guam; March 14, 1948 (K. L. Maehler). 1 ♂; Agaña, Guam; May 23, 1945 (J. L. Gressitt and G. E. Bohart). 1 ♂; same data, but August 4, 1945 (J. L. Gressitt). 1 ♀; same data, but January 30, 1948 (K. L. Maehler; on *Ipomoea*). 1 ♀, 6 ♂ ♂; Mount Alutom, Guam; June 6, 1946 (H. K. Townes). 7 ♂ ♂; same data, but June 18, 1946 (H. K. Townes). 2 ♂ ♂; Rota, Rota; June 20, 1946 (H. K. Townes; beginning to roost gregariously on *Casuarina equisetifolia* at sundown). 1 ♂; same data, but June 23,

1946 (H. K. Townes). 6 ♂ ♂ ; Oscilita, Rota: June 27, 1946 (R. G. Oakley). 1 ♂ ; native settlement, Saipan; June 18, 1946 (R. G. Oakley). 1 ♂ ; Susupe, Saipan; January 2, 1948 (K. L. Maehler). 1 ♂ ; Hagoya Lake, Tinian; June 10, 1946 (H. K. Townes).

**Scolia (Scolia) ruficornis** Fabricius

*Scolia ruficornis* Fabricius, 1793. Ent. syst. **2**: 230 [ ♂ ; Senegal; type in Paris (?)].

About 150 specimens of this African species were liberated in the Palaus in 1948 for control of *Oryctes rhinoceros* (Linnaeus). No reports have been received yet as to whether the species has become established.

I have included it in the key on the basis of specimens from Africa.

**Scolia (Triscolia) patricialis plebeja** (Gribodo)

*Triscolia patricialis* var. *plebeja* Gribodo, 1893. Bul. Soc. Ent. Ital. **25**: 168 [ ♀ , ♂ ; Borneo, Malacca; type in Genoa].

*Scolia* (*Triscolia*) *patricialis plebeja* (Gribodo) Betrem, 1928. Treubia, Suppl. vol. **9**: 235.

About 100 specimens of this wasp collected by T. R. Gardner in Malaya were liberated in the Palaus in 1948 for the control of *Oryctes rhinoceros*. Recently D. B. Langford, Staff Entomologist of the Trust Territory, wrote C. P. Clausen, of the Bureau of Entomology and Plant Quarantine, that he had seen specimens of this wasp in the field several months after liberations, an indication that the species is becoming established.

I have not examined specimens of the atypical subspecies *plebeja*, but have seen two females of the typical subspecies from North Borneo. These females have the head above antennae, scutellum, postscutellum, median dorsal surface of propodeum, median spot on dorsum of first abdominal tergite, and basal band on third tergite, orange. These specimens agree with Betrem's interpretation of *patricialis patricialis*. Betrem separates *patricialis plebeja* by the reduction or total absence of yellow markings on the thorax and first abdominal tergite.

FAMILY MUTILLIDAE

Esaki, 1938 (Annot. Zool. Jap. **17**: 431-2, fig.) records a female of the New Guinea *Timulla* (*Trogaspidia*) *albertisi* (André) from Ashiasu, Peleliu, Palau Islands. I view this determination with a great deal of suspicion, especially since Esaki states (italics mine), "My specimen agrees very well with the description of André (1896), *except for some details of the pubescence.*" Females in this genus are very difficult to determine, and separation depends in many cases on seemingly minute differences in the pubescence. Unfortunately Esaki does not mention what these differences are. Even though the wingless females in this genus are frequently carried in flight by the males during mating, I regard it as extremely

unlikely that the New Guinea species could become established in the Palaus in this way. In all probability the Palau form represents a discrete new species, but lacking material I am unable to carry the matter any further. Esaki has assigned the species to the correct genus, as his photograph is unmistakably that of a *Timulla*.

The female may be readily recognized by being wingless, about 10 mm. long, black with a pair of oval spots on the second abdominal tergite and a broad transverse band on the third tergite, both of pale, appressed pubescence. The male is unknown, but males of this genus are winged, have reniform compound eyes, large tegulae, and a sessile first abdominal segment.

### FAMILY POMPILIDAE

These wasps, popularly known as spider wasps from their habit of provisioning the cells for the young with paralyzed spiders, are poorly represented in Micronesia. Apparently the only endemic species is the new *Episyron* from the Palaus described below. In addition, there is the oceanic vagrant, *Anoplius opulentus* (Smith), which became established during and after the war in the Marianas and Palaus, and an *Auplopus* (*olim Pseudagenia*) probably introduced on Guam (my single specimen is in too poor condition for specific identification).

The three specimens before me may be separated by the following key:

1. Subdiscoidal vein of forewing meeting discoidal vein at a right angle so that third discoidal cell does not have a pocket at base. ♀ ♀ : Second abdominal sternite with a deep transverse groove before middle; pygidium a flattened, oval, shining or shagreened area. ♂ ♂ : First abdominal segment very slender and elongate, in length somewhat over four times the width at base; Marianas (Guam).....**Auplopus** species (p. 377)

   Subdiscoidal vein of forewing abruptly angulate at base and meeting discoidal vein at an acute angle so that the third discoidal cell has a distinct pocket at base. ♀ ♀ : Second abdominal sternite without a transverse groove; pygidial area not delimited, the last tergite uniformly convex and clothed with erect bristles. ♂ ♂ : First abdominal segment much broader, its length not over three times the width at base ..... 2

2. Pale integumental maculations lacking except on seventh tergite of male, the entire body strikingly ornamented with numerous spots of appressed silvery pubescence, none of pubescence consisting of modified scale-like setae; wings dusky, the tips darker; apical margin of clypeus subtruncate on middle two-thirds, mandibles not hidden by clypeus when head is viewed from in front. ♀ ♀ : Tarsal claws not cleft, but with a small erect tooth at middle. ♂ ♂ : Fourth abdominal sternite slightly con-

cave, covered with dense, suberect hairs having kinky tips; hypopygium tectiform; Marianas, Carolines (Palaus).....**Anoplius opulentus** (Smith) (p. 377)

Clypeus, face, occiput, pronotum, hind tibia and second and third abdominal tergites with ivory integumental maculations; some pubescence on pronotum, postscutellum, propodeum, first abdominal segment (and base of second also in male) dense, appressed and scale-like; wings clear hyaline, tips dusky; apical margin of clypeus broadly rounded, mandibles almost completely hidden by clypeus when head is viewed from in front. ♀ ♀ : Tarsal claws cleft. ♂ ♂ : Fourth abdominal sternite convex, without differentiated hairs; hypopygium slightly convex; Carolines (Palaus).....**Episyron maehleri,** new species (p. 378)

**Auplopus** species

I place here a single male from Point Oca, Guam; May 1945 (G. E. Bohart and J. L. Gressitt). The specimen is in deplorable condition, apparently having been mashed between the cork and lip of the collecting bottle, since the head is broken and most of the antennae and legs are missing. It is, however, recognizable as an *Auplopus* (*olim Pseudagenia*), because of the slender first abdominal segment and lack of a pocket at the base of the third discoidal cell of the forewing. I suppose it is an introduced species, as it was not taken on any of the earlier Guam surveys, but I am unable to match it with any of the available Philippine or North American species in the National Museum collection. However, males of only a few of the Philippine species are known.

**Anoplius opulentus** (Smith), new combination

*Pompilus opulentus* Smith, 1860. Jour. Proc. Linn. Soc. London, Zool. **5**: 120 [ ♀ ; Batjan Island, Moluccas; type in Oxford]. —Dalla Torre, 1897. Cat. Hym. **8**: 308.

*Pompilus elatus* Smith, 1865. Jour. Proc. Linn. Soc. London Zool. **8**: 82 [ ♀ ; Morotai Island, Moluccas; type in Oxford]. —Dalla Torre, 1897. Cat. Hym. **8**: 286.—Williams, 1945. Proc. Hawaii. Ent. Soc. **12**: 436-7, fig. 11 [ ♀ , ♂ ; descriptive notes; various localities in New Caledonia].—Williams, 1947. Occas. Papers B. P. Bishop Mus. **18**: 326 [quotes Turner's Fiji record]. New synonymy.

*Pompilus manokwariensis* Cameron, 1906. Res. Exped. Neerl. Nov. Guin. **5**: 55 [ ♀ ; Manokwari, Dutch New Guinea; type in Amsterdam]. New synonymy.

*Pompilus inquirendus* Vachal, 1907. Rev. d'Ent. **26**: 117 [ ♀ , ♂ ; New Caledonia; type in Paris]. New synonymy.

*Psammochares elatus* (Smith) Turner, 1917. Trans. Roy. Ent. Soc. London, 1917, p. 73 [records from Mackay and Townsville, Queensland, Australia].—Turner, 1919. Trans. Roy.

Ent. Soc. London, 1918, p. 340 [records from Fiji and New Caledonia; also synonymizes **inquirendus** Vachal].

*Anoplinellus minor* Banks, 1941. Occas. Papers B. P. Bishop Mus. **16**: 243, fig. 1 h [♀, ♂; Fulakora (?) and Auki, Malaita Island, Solomons; type in Honolulu]. New synonymy.

*Pompilinus* (?) sp., Williams, 1945. Proc. Hawaii. Ent. Soc. **12**: 425 [♂; Saipan].

Psammocharidae sp. Townes, 1946. Rpt. **14,** U. S. Comm. Co. Surv. Micronesia, p. 50 [Palaus and Marianas].

Apparently the nesting habits of this wasp are such that it has been readily transported by commerce in the past, and with the advent of air travel the adults themselves are probably being transferred to new localities. It seems likely that this species came originally from the East Indies and reached by successive steps New Guinea, Australia and the Solomon Islands. The colonies in the Palaus and Marianas reported below seem to have been established by air transport during the war, in part at least, for H. K. Townes informs me that specimens were found most commonly in the vicinity of airfields.

The new synonymy listed above is based almost entirely on the original descriptions. The pattern of silvery pubescence is quite striking, and is mentioned by each of the authors. At my request H. K. Townes kindly made notes on the male allotype of *Anoplinellus minor* Banks at the Museum of Comparative Zoology at Harvard College which further confirmed my suspicion as to the identity of that species.

I have seen specimens from New Caledonia, New Guinea and the Solomons, in addition to those from Micronesia listed below:

MARIANA ISLANDS: 1 ♀; Mt. Lasso, Tinian; June 9, 1946 (H. K. Townes). 1 ♀; Tinian; June 11, 1946 (R. G. Oakley). 1 ♂; Charan Kanoa, Saipan; August 20, 1944 (D. G. Hall). 1 ♂; U. S. Commercial Co. farm, Saipan; June 17, 1946 (R. G. Oakley). 1 ♀; Susupe, Saipan; January 1, 1948 (K. L. Maehler). 1 ♀; Agaña airport, Guam; May 23, 1948 (K. L. Maehler).

CAROLINE ISLANDS: 2 ♀ ♀, 2 ♂ ♂; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes).

**Episyron maehleri,**[4] new species

Psammocharidae sp. Townes, 1946. Rept. **14,** U. S. Comm. Co. Surv. Micronesia, p. 50 [Palaus].

The present species seems closest to the Bombay, India, *decoratus* (Smith), and may be identical with the female recorded as *decoratus* from Formosa by Yasumatsu, 1937 (Mushi **10**: 72). Females of both species agree in being more or less shining, and in having the clypeus broadly rounded apically and the short

[4] For K. L. Maehler, Division of Foreign Plant Quarantine, Bureau of Entomology and Plant Quarantine, whose collections in Micronesia have added much to the completeness of the present paper.

tarsal comb. However, they differ in several details of coloration which seem of specific importance. Thus, *decoratus* is essentially a more extensively maculated species, having ivory maculations along the inner and outer eye margins, posterior margin of pronotum, posteriorly on the mesoscutum, on the mesopleuron below the wing base, at base of hind tibia, a pair of lateral spots on the second and third abdominal tergites, and a fascia at the base of the fifth tergite, but the clypeus is entirely black; *maehleri* is much less extensively maculated with ivory, lacking spots on the mesoscutum, mesopleuron and fifth tergite, but the third tergite has a broad fascia instead of lateral spots, and the clypeus is entirely pale except for the narrow apical margin and a quadrate mark at the base. The scutellum in *maehleri* is very prominently gibbose and the interocellar area is flat; these characters are not mentioned in the descriptions of *decoratus*. *E. maehleri* is distinguished from any of the known Philippine species by the combination of characters listed above.

Type: ♀ ; northeast corner of Koror Island, Palaus; July 22, 1946 (H. K. Townes; in native forest on rough limestone rocks). [U. S. National Museum, Type No. 59034.]

*Female*—Length 9 mm. (apical abdominal segments somewhat telescoped), forewing 9 mm. Black, shining, with dark blue reflections in certain lights; mandible ferruginous near tip; clypeus except narrow apical margin and quadrate basal mark, a band (broader below) along inner eye margin from base of clypeus to a point opposite anterior ocellus, narrower band along outer eye margin, band on pronotum extending from tubercles, narrowed toward middle and slightly interrupted there, small spot near base of hind tibia externally, rounded anterolateral spot on second tergite emarginate behind, and broad fascia at base of third tergite emarginate at middle of posterior margin, ivory. Wings hyaline, iridescent, tip of forewing infumated, veins fuscous. Body rather evenly covered with short, moderately dense sericeous pubescence having slight silvery reflections in certain lights; the head, thorax, coxae beneath, and abdomen with short, erect dark hairs, denser on head and fore coxae than on thorax, extremely sparse on abdomen; in addition, the pronotum, side of scutellum, postscutellum, propodeum and first abdominal tergite with appressed, short scales having silvery to pale greenish blue reflections, dense on first tergite, more scattered elsewhere.

Head in anterior aspect subcircular, flattened across the top, its greatest width 1.14 times the height from apical margin of clypeus to top of head; mandibles almost entirely covered by the large clypeus; apical margin of clypeus very broadly rounded, not reflexed nor impunctate, its length in middle half the greatest width; eyes strongly convergent posteriorly, the interocular distance at hind ocelli narrow, equal to the length of the second flagellar segment and only 0.54 times the interocular distance at base of clypeus; interocellar area flat, the ocelli in a low triangle, the postocellar distance 1.7 times the ocellocular distance; antennae long and slender, the scape, pedicel and first two flagellar segments in a ratio of about 3:1:5:3.

Pronotum evenly and shallowly arcuate posteriorly; scutellum strongly gibbose, flattened anteriorly in the middle, the sides and posterior abruptly declivous.

Anterior coxa and trochanter together as long as mesopleuron; anterior tarsus with a comb of short spines, the basitarsus with three spines, none of them longer than second tarsal segment; pulvillar comb consisting of about nine moderately long, subparallel setae.

Forewing with third submarginal cell strongly narrowed above, its width

on radial vein half its width on cubital, basal and transverse median veins interstitial; cubitus in hind wing interstitial with transverse median vein.

Allotype: ♂; Koror Island, Palaus; March 15-25, 1948; (K. L. Maehler). [U. S. National Museum.]

*Male*—Length 7 mm., forewing 6 mm. Coloration and pubescence as in female with the following exceptions: Clypeus black, hind tibia ivory on basal half externally and ferruginous beneath, anterolateral ivory spot on second tergite very much reduced in size, fascia on third tergite broadly interrupted in middle, second tergite with some scattered, short appressed scales.

Head in frontal view tending toward subcordate, flattened above, its greatest width 1.16 times the height from apex of clypeus to top of head, mandibles almost completely covered by the large clypeus; apical margin of clypeus rounded, though tending toward subtruncate on median two-thirds, not reflexed, the length in middle half the greatest width; eyes not so strongly convergent above as in female, the interocular distance across narrowest part of vertex 0.88 times the interocular distance at base of clypeus and over twice the length of the second flagellar segment; ocelli in a low triangle, the interocellar area flat, the postocellar distance 0.8 times the ocellocular distance; antennae shorter and stouter than in female, the scape, pedicel and first two flagellar segments in a ratio of about 3:1:3:3.

Thorax much as in female, the scutellum not quite so prominently gibbose. Hypopygium slightly convex, the apex broadly rounded.

## FAMILY SPHECIDAE

### Key to the Micronesian Species

1. Forewing with one or three submarginal cells, if with three, the second never petiolate above; inner margin of compound eye not deeply emarginate except in *Trypoxylon philippinense* which has only one submarginal cell ..... 2

   Forewing with three submarginal cells, the second petiolate above; inner margin of compound eye deeply emarginate except in *Solierella rohweri*..... 18

2. Abdomen basally with a long, slender petiole composed of first sternite only, the first tergite a small cap at apex of segment, the petiole longer than remainder of abdomen; large, slender, metallic blue or black and yellow forms, 15 mm. or more in length..... 3

   Abdomen usually sessile, if petiolate (*Trypoxylon philippinense, Dasyproctus immaculatus* and *Dicranorhinus* sp.) the petiole consisting of both tergite and sternite and not as long as rest of abdomen; smaller species, not metallic blue, entirely without yellow maculations except in *Lestica constricta,* not over 10 mm. in length.... 6

3. Apical margin of clypeus tridentate in middle; dorsum of propodeum not set off from lateral and posterior surfaces by a U-shaped groove; metallic blue; Gilberts (Tarawa) .....**Chalybion bengalense** (Dahlbom) (p. 386)

   Apical margin of clypeus truncate in middle or with a narrow central emargination dividing the middle section into two rounded lobes; dorsum of propodeum set off from lateral and posterior surfaces by a deep U-shaped groove; black and yellow forms. *Sceliphron*..... 4

4. Viewed from above the hind coxa rectangulate at base on outer margin; side of propodeum impunctate between the oblique rugae; female with apex of fourth abdominal tergite and last two segments entirely, male with apices of fourth and fifth, and sixth and seventh tergites entirely, yellow; Marianas, Carolines (Palaus) ..... **Sceliphron laetum** (Smith) (p. 386)

Viewed from above the hind coxa rounded at base on outer margin; side of propodeum punctate between the oblique rugae; apex of abdomen entirely black ..... 5

5. Sides of thorax dull; erect hair of head and thorax dark brown except on yellow maculations; hind trochanter and femur, and petiole of abdomen black; first tergite usually yellow in part; Marshalls, Marianas ..... **Sceliphron caementarium** (Drury) (p. 388)

Sides of thorax shining; erect hair of head and thorax pale; hind trochanter, basal half of hind femur and abdominal petiole, yellow; first tergite entirely black; Carolines (Palaus) .... **Sceliphron madraspatanum** (Fabricius) (p. 387)

6. Forewing with one submarginal cell; hind ocelli normal, circular, convex ..... *7*

Forewing with three submarginal cells; hind ocelli distorted, flattened, subovate ..... 9

7. Inner margin of compound eye deeply emarginate; elongate slender form with petiole of first abdominal segment slightly longer than hind tibia; abdomen red and black; Marianas (Guam) ..... **Trypoxylon philippinense** Ashmead (p. 400)

Inner margin of compound eye straight; short, stocky forms with first segment of abdomen sessile or subpetiolate; abdomen immaculate or black and yellow ..... 8

8. Dull, mat, nearly impunctate, immaculate form with first segment of abdomen subpetiolate (more strongly so in male) and somewhat nodose at apex, the other abdominal segments not noticeably constricted at base and apex; antennal scape bicarinate beneath; legs of male not modified; Carolines (Palaus) ..... **Dasyproctus immaculatus,** new species (p. 392)

Shining, coarsely and closely punctate form with abundant yellow maculations, the first abdominal segment sessile, not nodose at apex, the second to fifth segments noticeably constricted at base and apex; antennal scape ecarinate beneath (male) or weakly unicarinate (female); legs of male greatly modified, the fore femur flattened beneath and densely hairy, the fore and mid tarsi strongly flattened; Carolines (Palaus) ..... **Lestica (Solenius) constricta,** new species (p. 389)

9. Front along margin of eye not swollen; posterior ocelli oblique in position; pronotum with a distinctly dorsal

posterior surface, the mesoscutum not overhanging the pronotum; Marianas, Carolines (Palaus)..... **Tachysphex bengalensis** Cameron (p. 393)

Front along margin of eye with a longitudinal swelling; posterior ocelli transverse in position; pronotum without a distinct dorsal surface posteriorly, more or less overhung by the mesoscutum..... 10

10. Mandible with a conspicuous tooth beneath near base..... 11

Mandible not toothed beneath near base. *Liris*[5]..... 15

11. First abdominal segment petiolate, the apex much narrower than the width of the second segment; top of head flattened, the anterior ocellus not in a depression; Carolines (Palaus)..... **Dicranorhina** species (p. 394)

First abdominal segment sessile apically, not narrower than the base of the second segment; top of head with a broad depressed area around the anterior ocellus. *Motes*..... 12

12. Entire body dull through excessively fine, dense punctation, the individual punctures on thorax not resolvable under 48 diameters magnification; dorsum of propodeum either very faintly or not at all rugosoreticulate; hind femur in male excavate beneath near base..... 13

Body shining, the punctures larger and resolvable at as low as 10 diameters magnification; dorsum of propodeum coarsely rugosoreticulate; hind femur of male rounded beneath..... 14

13. Side of propodeum with oblique rugae developed to some extent. ♀ ♀ : Wings not infumated with yellow; apical third of clypeus shining and practically impunctate. ♂ ♂: Concave part of under surface of fore femur with short, dense, appressed silvery hairs; apical margin of clypeus rounded outwardly in middle; Marshalls..... **Motes subtesselatus** (Smith) (p. 394)

Side of propodeum not at all rugose. ♀ ♀ : Wings strongly infumated with yellow; clypeus punctate almost to apical margin, with only a very narrow, shining, impunctate rim. ♂ ♂ : Concave part of under surface of fore femur with dense, longer, suberect silvery hairs; apical margin of clypeus subtruncate in middle; Marianas..... **Motes laboriosus** (Smith) (p. 394)

14. Thoracic punctation relatively dense, most of those on mesopleuron separated by not more than the diameter of a puncture. ♀ ♀ : Pygidial punctation contiguous, interspaces not noticeable. ♂ ♂ : Paramere of genitalia abruptly narrowed at middle, the apical half more slender; Marianas, Carolines..**Motes manilae** (Ashmead) (p. 395)

Thoracic punctation comparatively much sparser and

[5] *Liris mindanaoensis carolinensis* Yasumatsu is not included in this key. See discussion of this species below.

finer, most of those on mesopleuron separated by several times the diameter of a puncture. ♀ ♀ : Pygidial punctation sparser, the interspaces noticeable. ♂ ♂ : Paramere more gradually narrowed, the apical half not as slender as in above species; Carolines (Palaus) ..... **Motes townesi,** new species (p. 396)

15. Head with a short horizontal section behind eyes; head and thorax with abundant, appressed golden pubescence; antennal scape, tegula and legs except coxae and trochanters, ferruginous; anterior tibia with a row of spines above; Marshalls, Marianas, Carolines: ..... **Liris opulenta** (Lepeletier) (p. 397)

Head abruptly declivous behind top of eyes; head and thorax with the pubescence sparse, silvery, and usually suberect; entirely black; anterior tibia not spinose above..... 16

16. Dorsum of propodeum with stronger carinae curving outwardly; mesoscutal punctation sparser posteriorly, most of punctures there separated by more than the width of a puncture; wings strongly infumated with brown and with violaceous reflections; pygidial pile of female dark brown; male with carinae on lateral surface of propodeum practically absent; Carolines (Truk, Yap)..... **Liris esakii** Yasumatsu (p. 397)

Dorsum of propodeum with much weaker, oblique carinae; mesoscutal punctation denser posteriorly than in *esakii*, most of the punctures separated by distinctly less than the width of a puncture; wings either hyaline with the extreme tips darker (*williamsi*), or infumated (*samoensis*) though less strongly so than in *esakii*..... 17

17. Wings clear hyaline, the extreme tips slightly darkened, and with iridescent reflections; posterior surface of propodeum dull, scabrous; pygidial pile of female dark brown; male unknown; Carolines (Palaus)..... **Liris williamsi,** new species (p. 398)

Wings moderately infumated with yellowish brown, and with violaceous reflections; posterior surface of propodeum shining, not scabrous; pygidial pile of female pale golden; male with well-developed carinae on part of lateral surface of propodeum; Carolines (Ponape)..... **Liris samoensis** Williams (p. 398)

18. Inner margin of compound eye straight; marginal cell truncate at apex; size small, not over 4.5 mm. long; Marshalls..... **Solierella rohweri** (Bridwell) (p. 399)

Inner margin of compound eye deeply emarginate in middle; marginal cell acute at apex; size larger, rarely less than 5.5 mm. long. *Pison*..... 19

19. Front with large contiguous punctures; thorax with rather dense, large punctures, the interspaces shining; dorsal surface of propodeum with strong, oblique carinae;

hypopygium of male broadly and deeply emarginate at apex, the lateral arms long and slender; Marshalls, Marianas, Carolines.....**Pison punctifrons** Shuckard (p. 400)

Front and thorax with smaller, usually more scattered punctures, the interspaces on thorax usually dull, shining in only a few species; dorsal surface of propodeum smooth and sparsely to rather densely punctate, or if obliquely carinate, the carinae very fine; hypopygium of male truncate or with a very shallow emargination at apex; the lateral arms very short..... 20

20. Head and thorax with the erect pubescence dense and black ..... 21

Head and thorax with the erect pubescence either entirely lacking or dense but when present always silvery except brownish on mesoscutum in *ponape*..... 22

21. Lateral surface of propodeum separated from dorsal and posterior surfaces by a strong carina extending from the spiracle almost to the apex; median carina on dorsal surface of propodeum strong, complete, and contained in a moderately deep sulcus; clypeal lobe semicircular in outline; wings infuscated with dark brown and with violaceous reflections; larger, ♀ 9-11 mm. long; Marianas.....**Pison esakii** Yasumatsu (p. 401)

No such carina separating the lateral from dorsal and posterior surfaces of propodeum; median carina on dorsal surface of propodeum very weak, evanescent posteriorly, and contained in a very weak, shallow sulcus; clypeal lobe more or less pentagonal in outline; wings hyaline and with iridescent reflections; smaller, ♀ 8 mm., ♂ 7.2 mm. long; Carolines (Ponape)..... .....**Pison nigellum,** new species (p. 401)

22. Decumbent silvery pubescence on clypeus so dense that it obscures the punctation; second recurrent vein of forewing received in middle of second submarginal cell; tibial calcaria pale..... 23

Clypeal pubescence sparser, not obscuring the punctation; second recurrent vein of forewing interstitial with second transverse cubital vein or received in third submarginal cell near base; tibial calcaria black..... 24

23. Smaller forms, average length of ♀ 6.0 mm., of ♂ 5.0 mm.; oblique carinae on dorsum of propodeum weaker, usually evanescent toward margins; apical margin of clypeal lobe of female not depressed in middle; punctation finer, though equally as dense; Marianas (Guam), Carolines (Ponape, Truk)..... .....**Pison argentatum** Shuckard (p. 403)

Larger forms, average length of ♀ 8.0 mm., of ♂ 7.0 mm.; oblique carinae on dorsum of propodeum stronger, usually complete to margins; clypeal lobe of female

depressed in middle of apical margin giving it a bilobed appearance; punctation coarser; Carolines (Palaus)..... .....**Pison ignavum** Turner (p. 404)

24. Mesopleuron with large, coarse, subcontiguous punctures, the interspaces shining; third sternite of male not tuberculate or ridged; ocellocular distance in female at least half the postocellar distance; larger, ♀ usually over 9 mm., ♂ over 8 mm. in length..... 25

Mesopleuron with smaller punctures separated by at least the width of a puncture, the interspaces dull from shagreening except in *oakleyi*; third sternite of male tuberculate or ridged; ocellocular distance in female much less than half the postocellar distance; smaller, ♀ not over 8 mm., ♂ not over 7 mm. in length..... 27

25. Clypeal lobe triangular; second sternite densely punctate, the punctures separated by not much more than the diameter of a puncture; Marshalls, Carolines (Palaus) .....**Pison hospes** Smith (p. 404)

Clypeal lobe rounded or more or less pentagonal in outline; second abdominal sternite more sparsely punctate, the punctures separated by several times the diameter of a puncture..... 26

26. Dorsum of propodeum with median carina well-defined on at least the basal half, the median sulcus more or less evanescent on anterior half, but present posteriorly; posterior surface of propodeum finely, transversely rugulosopunctate; wings moderately infumated with brown and with faint violaceous reflections; Marshalls .....**Pison tahitense** Saussure (p. 405)

Dorsum of propodeum without a median carina, but the median sulcus deeper on entire length of surface; posterior surface of propodeum on lower half with about four strong transverse rugae, not punctate; wings clear hyaline and with iridescent reflections; male unknown; Carolines (Ponape)..... .....**Pison ponape,** new species (p. 405)

27. Mesopleuron shining, the impunctate interspaces not delicately shagreened; wings rather strongly infumated with dark brown and with violaceous reflections; third sternite of male with a small, low, rounded tubercle near middle; Marianas....**Pison oakleyi,** new species (p. 406)

Mesopleuron opaque, the impunctate interspaces delicately shagreened; wings not infumated with brownish, the reflections iridescent; third sternite of male either with a short transverse ridge or a pair of mammilate tubercles in middle..... 28

28. Front finely granulate and with superimposed shallow punctures, the interspaces broader and not forming a network of fine carinae; third sternite of male with a

short transverse ridge in middle; Marshalls, Marianas, Carolines (Ponape, Truk, Palaus).....
.....**Pison iridipenne** Smith (p. 408)

Front with deeper, closer punctures, the interspaces very narrow and forming a network of fine carinae; third sternite of male with a pair of mammilate tubercles in middle; Carolines (Palaus).....
.....**Pison korrorense** Yasumatsu (p. 409)

**Chalybion bengalense** (Dahlbom)

*Pelopoeus violaceus* Lepeletier and Serville, 1825. Encycl. meth. Ins. **10**: 35 [♀; East Indies; misidentification of *Sphex violacea* Fabricius, 1775].

*Pelopoeus* (*Chalybion*) *Bengalensis* Dahlbom, 1845. Hym. Europ. **1**: 433 [Bengal; type in Lund, Sweden].

*Sceliphron* (*Chalybion*) *bengalense* (Dahlbom) Kohl, 1918. Ann. Naturhist. Hofmus. Wien **32**: 54 [♀, ♂; redescription in revision; records from Ethiopian, Oriental and Australian regions].

This species has a wide distribution in the Palaearctic, Ethiopian, Oriental and Australian regions, and has become established just recently in Hawaii (Weber, 1948. Proc. Hawaii. Ent. Soc. **13**: 205; first captured in Hawaii in 1947). D. G. Hall informs me that he found the species to be relatively common on Tarawa in the Gilbert Islands in 1945, so perhaps the first migrants to Hawaii came from that particular population. Presumably the species was established on Tarawa during the Japanese occupation either from Japan or the Philippines.

Horne, 1870 (Trans. Zool. Soc. London **7**: 163-4, pl. 21, figs. 2, 2a), notes that this species in India constructs one or more clay cells which are provisioned with small spiders.

GILBERT ISLANDS: 1♀, 3♂♂; Tarawa Island; July 23, 1945 (D. G. Hall) [KVK].

**Sceliphron laetum** (Smith)

*Pelopoeus laetus* Smith, 1856. Cat. Hym. Brit. Mus. **4**: 229, pl. 7, fig. 1 [♀, ♂; Australia, Ceram; type in London].

*Sceliphron* (*Pelopoeus*) *laetum* (Smith) Kohl, 1918. Ann. Naturhist, Hofmus. Wien **32**: 95, figs. 24, 49 [♀, ♂; redescription in revision; records from Moluccas, New Guinea, New Britain, Australia and New Zealand].

*Sceliphron* sp. Townes, 1946. Rpt. **14**, U. S. Comm. Co. Surv. Micronesia, p. 50 [common in the Palaus].

This species is readily distinguished from all known species of the genus by the combination of the hind coxa being rectangulate at the base on the outer margin and the apical segments of the abdomen being yellow.

The colonies on Guam and the Palaus almost certainly were

established during the war years by military traffic from the Solomons, and perhaps New Guinea. Several years ago G. E. Bohart informed me that specimens of this species accompanied the ship on which he sailed from the Solomons to Guam early in 1945.

This and the following two species build clay cells which they provision with small spiders.

I have seen material from Australia, New Guinea and the Solomons in addition to that listed below from Micronesia:

MARIANA ISLANDS: 1 ♂ ; Inarajan, Guam; March 6, 1948 (K. L. Maehler).

CAROLINE ISLANDS: 5 ♀ ♀, 12 ♂ ♂ ; Arakabesan Island, Palaus; July 18, 1946 (H. K. Townes). 6 ♀ ♀, 1 ♂ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler).

**Sceliphron madraspatanum** (Fabricius)

*Sphex madraspatana* Fabricius, 1781. Spec. ins. **1**: 445 [Malabar; type in London (?)].

*Pelopoeus interruptus* Palisot de Beauvois, 1805. Ins. rec. Afr. Amer., Hym., p. 50, pl. 7, fig. 5 [type in London (?)].

*Pelopaeus bilineatus* Smith, 1852. Ann. Mag. Nat. Hist. (2) **9**: 47 [ ♀ ; Bombay, India; type in London].

*Pelopaeus separatus* Smith, 1852. Ann. Mag. Nat. Hist. (2) **9**: 47 [ ♀ ; Bombay, India; type in London].

*Pelopoeus pictus* Smith, 1856. Cat. Hym. Brit. Mus. **4**: 231 [ ♂ ; India; type in Oxford (?)].

*Pelopoeus conspicillatus* A. Costa, 1864. Ann. Mus. Zool. Napoli **2**: 112 [ ♀ , ♂ ; Luzon, Philippines; type in Naples].

*Sceliphron* (*Pelopoeus*) *kohli* Sickmann, 1894. Zool. Jahrb., Abt. f. Syst. **8**: 218 [ ♀ , ♂ ; Tientsin, China; type in Münster (?)].

*Sceliphron* (*Pelopoeus*) *madraspatanum* (Fabricius) Kohl, 1918. Ann. Naturhist. Hofmus. Wien **32**: 109 [ ♀ , ♂ ; redescription in revision; records from India, Ceylon, Assam, Burma, Malaya, Sumatra, Java, Borneo, Philippines and Formosa].

*Sceliphron* sp. Townes, 1946. Rpt. **14**, U. S. Comm. Co. Surv. Micronesia, p. 50 [common in the Palaus].

This and the following species belong in the group having the hind coxa rounded at base on outer margin as contrasted with the group exemplified by the preceding species in which this coxa is rectangulate at base on outer margin. Although *madraspatanum* is closely related to *caementarium*, the two are easily separated by the characters noted in the key.

I assume this species was introduced recently to the Palaus from the Philippines, for Yasumatsu does not record it from pre-war material from the Palaus.

CAROLINE ISLANDS: 1 ♀ , 7 ♂ ♂ ; Arakabesan Island, Palaus; July 18, 1946 (H. K. Townes). 1 ♀ ; Gapik, Babelthuap Island, Palaus; July 19, 1946 (R. G. Oakley). 1 ♀ ; Babelthuap

Island; July 26, 1946 (H. K. Townes). 2 ♂ ♂ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler).

**Sceliphron caementarium** (Drury)

*Sphex caementaria* Drury, 1770. Illustr. Nat. Hist. **1**: 105, pl. 44, figs. 6-8; pl. 45, figs. 8, 10 [ ♀ , ♂ ; West Indies].

*Sphex flavomaculata* DeGeer, 1773. Mem. hist. Ins. **3**: 588, pl. 30, fig. 4 [ ♀ ; Pennsylvania; type in Stockholm].

*Sphex lunata* Fabricius, 1775. Syst. ent., p. 347 [Antigua; type in Kiel (?)].

*Sphex flavipes* Fabricius, 1781. Spec. Ins. **1**: 444 [America; type in Kiel (?)].

*Sphex flavipunctata* Christ, 1791. Naturges. Ins., p. 301, pl. 30, fig. 1 [West Indies; apparently proposed for *caementaria* Drury].

*Sphex affinis* Fabricius, 1793. Ent. syst. **2**: 203 [West Indies; type in Kiel (?)].

*Pelopoeus architectus* Lepeletier, 1845. Hist. nat. ins. Hym. **3**: 313 [ ♀ ; New Orleans; type in Turin (?)].

*Pelopoeus Servillei* Lepeletier, 1845. Hist. nat. ins. Hym. **3**: 313 [ ♀ ; type locality unknown; type in Paris].

*Pelopoeus Solieri* Lepeletier, 1845. Hist. nat. ins. Hym. **3**: 318 [ ♀ ; Guadaloupe; type in Paris].

*Pelopoeus Canadensis* Smith, 1856. Cat. Hym. Brit. Mus. **4**: 233 [ ♂ ; Canada; type in London].

*Pelopoeus nigriventris* A. Costa, 1864. Ann. Mus. Zool. Napoli **2**: 60 [North America; type in Naples].

*Pelopoeus tahitensis* Saussure, 1867. Reise d. Novara, Zool. **2**: 27, pl. 2, fig. 17 [ ♀ , ♂ ; Tahiti; type in Geneva].

*Sceliphron (Pelopoeus) caementarium* (Drury) Kohl, 1918. Ann. Naturhist. Hofmus. Wien **32**: 115, figs. 4, 58 [ ♀ , ♂ ; redescription in revision; records from North and Central America, West Indies and Tahiti].

*Sceliphron caementarium* (Drury) Townes, 1946. Rpt. **14**, U. S. Comm. Co. Surv. Micronesia, p. 50 [common on Tinian and Saipan].

This New World species has been established in Hawaii and Tahiti for a number of years, and it is likely that the colonies in the Marshalls and Marianas were established from specimens from Hawaii during the war.

MARSHALL ISLANDS: 3 ♀ ♀ , 4 ♂ ♂ ; airport on Kwajalein Island; November 4, 1946.

MARIANA ISLANDS: 1 ♂ ; Afetna Point, Saipan; June 27, 1946 (H. K. Townes). 1 ♀ , 4 ♂ ♂ ; Tinian; June 8, 1946 (H. K. Townes). 1 ♀ ; central section of Tinian; December 31, 1947 (K. L. Maehler). 1 ♀ ; Agaña airport, Guam; May 23, 1948 (K. L. Maehler).

**Lestica (Solenius) constricta,** new species

*Crabro* (*Ceratocolus*) *quadriceps* Bingham, Yasumatsu, 1939. Mushi **12**: 153, pl. 6, figs. 1-4 [ ♂ ; Babelthuap Island, Palaus; misidentification].

*Crabro quadriceps* Bingham, Townes, 1946. Rpt. **14,** U. S. Comm. Co. Surv. Micronesia, p. 51 [common in the Palaus].

Yasumatsu's description and figures agree in all essential respects with the series of males before me. There is, likewise, no doubt that the present species is distinct from the true *quadriceps* of Bingham. There are too many points of difference, in both sculpture and color, between Bingham's description of the female *quadriceps* and my series of three females of the present species. Furthermore, *quadriceps* has been placed in the synonymy of the widely distributed *alata* (Panzer), questionably by Kohl, 1915 (Ann. k. k. Naturhist. Hofmus. Wien **29**: 125), and definitely by Turner, 1912 (Ann. Mag. Nat. Hist. [8] **10**: 376), a species which belongs to the typical subgenus rather than to *Solenius.*

Later, Yasumatsu, 1942 (Mushi **14**: 90), recorded additional material of both sexes of *quadriceps* from China and Formosa. If these latter specimens are conspecific with Palau material, and I have no reason to doubt Yasumatsu's placing them together, *constricta* has a fairly extended range and probably will be found also in the Philippines. Therefore, the possibility exists that the species is not endemic in the Palaus, but was introduced perhaps from Formosa or the Philippines.

The present species appears to be most closely related to *Lestica* (*Solenius*) *wollmanni* (Kohl), new combination, from Turkestan (Kohl, 1915. Ann. k. k. Naturhist. Hofmus. Wien **29**: 121 [ ♀ ; described as *Crabro* (*Ceratocolus*)]), agreeing with that species in the very strongly constricted abdominal segments. The male described as the opposite sex of *wollmanni* by Kuznetzov-Ugamskij, 1927 (Zool. Anz. **71**: 244; [ ♂ ; Berkara, 70 km. west of Aulie-Ata in central Asia]), may be incorrectly associated, since it appears to belong to the subgenus *Clypeocrabro.* However, the distinctions between *Clypeocrabro* and *Solenius* seem difficult to maintain.

The female of *constricta* differs in having the postscutellum black (yellow in *wollmanni*) and the abdominal tergites one to five each with a pair of yellow spots, those of one, two and five being very narrowly separated in the middle (*wollmanni* has bands on one, four and five, lateral spots on two and three). Kohl mentions that the punctation of the abdominal tergites in *wollmanni* is sparser than in *clypeata* (Schreber), whereas the punctation in *constricta* is extremely close, much more so than in *clypeata.* Kohl does not mention the hind margins of the first five abdominal tergites in *wollmanni,* so I assume they are not reflexed in that species, whereas they are in *constricta.* The male which Kuznetzov-Ugamskij associates with *wollmanni* is at once

separated from the male of *constricta* by having the median flagellar segments longer than broad (about as long as broad in *constricta*) and in having the head much more narrowed behind the compound eyes, much as in *clypeata*.

Nothing is known of the habits of this species, but other members of the subgenus nest in stems of pithy plants or in old beetle borings and provision their nests with adult Diptera or Lepidoptera.

Type: ♂ ; northeast corner of Koror Island, Palaus; July 22, 1946 (H. K. Townes). [U. S. National Museum. Type No. 59035].

*Male*—Length 9 mm., forewing 5.9 mm. Black, rather dull from excessively close punctation, except temples, mesopleuron and second abdominal sternite which are shining; mandible near tip, hind tibia beneath, and hind tarsus above, castaneous; flagellum beneath, tegula, fore tarsus except basal segment, mid femur with a stripe on outer surface, mid tibia beneath, mid tarsus entirely, and hind tarsus beneath, ferruginous; scape except a spot at base behind, broad band along fore margin of pronotal disk narrowly interrupted in middle, pronotal lobe, small spot in middle of scutellum, transverse lateral spots on first to fifth tergites separated in middle by at least half the width of each segment, those of the second the largest and wider laterally, those of the fifth the smallest, mid femur with a stripe behind on outer surface, mid tibia on basal two-thirds of outer surface, and a stripe on outer side of hind tibia on nearly the entire length, flavous; mid coxa behind, hind coxa beneath on apical half, fore trochanter, fore femur except at base of outer surface, fore tibia, and fore basitarsus, stramineous. Front, vertex, dorsum of thorax and of abdomen with short, erect dark brown setae; clypeus, an oblique patch on lower temple parallel with hypostomal carina, lower inner eye margin, mesosternum, and a large, lateral rounded patch on second sternite with dense, short, appressed silvery hairs; remainder of temple, mesopleuron and second sternite with sparser, longer silvery subappressed hairs; fore coxa beneath, all trochanters beneath, fore femur beneath and on upper part of hind surface, and fore tibia beneath with dense, erect white hairs, those on fore femur the longest. Wings moderately infumated with brownish.

Head in frontal view obtrapezoidal, the ratio of height (from apex of clypeus to top of eye) to greatest width (near top of eye) to least width (at posterior mandibular condyle) about 14:13:9; mandible bidentate at tip; clypeus with median length 0.4 times its width, the median longitudinal ridge becoming broader and flattened at apex, the apical margin irregularly rounded, but not dentate; antennal scape ecarinate, three times the interocular distance across middle of antennal fossae, equal in length to the first six flagellar segments; the latter slightly broader than long except for the ultimate which is twice as long as broad, unmodified except for a series of carina-like tyloides beneath on the third to tenth; from above the head evenly narrowed behind eyes, the ratio of its greatest width to least width (just before occipital carina) to median length about 13:9:10; ocellocular distance equal to postocellar distance, the ocelli in an isosceles triangle, postocellar distance 1.5 times the anterolateral ocellar distance; temple broad, flat, its width across middle 1.5 times the width of eye at middle; scapal area glabrous, impunctate; inner eye margin, upper half of front, and vertex with coarse, contiguous punctures, those of vertex much larger; temple with large scattered punctures except an oblique patch of close, fine ones below; occipital carina foveate above, and again beneath near the hypostomal carina.

Pronotum anteriorly with a transverse, cristate carina, notched in middle and terminating laterally in a large tooth, the width at teeth equal to width of head at occiput; the dorsal surface with punctures contiguous and about as fine as on upper part of front, posteriorly strongly impressed and foveate; mesoscutum with punctures anteriorly as on dorsum of prothorax, toward the rear becoming larger; scutellum punctured like mesoscutum posteriorly; post-

scutellum in middle with dense, finer punctures; mesopleuron with large, deep punctures usually separated by about half the diameter of a puncture; metapleuron longitudinally rugulose; propodeum on lateral surface longitudinally rugulose with a few close punctures posteriorly, dorsal and posterior surface of propodeum rugosoreticulate, the posterior surface more finely so and with smaller reticulations.

Legs modified as follows: Fore leg except coxa flattened beneath, the trochanter lamellate but not toothed, the tarsi patellate, basitarsus with inner margin concave, outer convex, somewhat more than twice as long as width at apex or the following three segments united; mid femur short, its basal width half its length, the hind margin lamellate, mid tibia stout, strongly curved as viewed from side, the tarsi patellate, though not so thin as fore tarsi, the basitarsus concave on fore margin, straight on hind; hind basitarsus slightly flattened beneath, the fore margin convex.

Forewing with marginal cell almost four times as long as wide; first and second abscissae of radius equal in length; second abscissa of cubitus one-fourth the length of first abscissa, the latter subequal in length to transverse cubitus.

Abdomen with first four tergites with reflexed apical margins, the first to fifth just before apex, and the second to fifth at base, deeply constricted; second and third sternites at apex and third at base, constricted; the constricted areas of the first five tergites densely and rather minutely punctate, elsewhere with larger, subcontiguous punctures and glabrous interspaces; exposed parts of sixth and seventh tergites with moderately dense, small punctures, the seventh with a shallow longitudinal depression in middle.

The male paratypes vary in length from 8 to 9.5 mm. and differ from the above in that the median spot on the scutellum is evanescent or lacking in about half the series.

Allotype: ♀; same data as type. [U. S. National Museum.]

*Female*—Essentially very similar to male except in the details noted below.

Length 9 mm., forewing 6 mm.; all tarsi except basitarsi, ferruginous; scape entirely, pedicel beneath, dorsum of pronotum and scutellum almost entirely, broad lateral spots on first to fifth tergites, those of first, second and fifth very narrowly separated in middle, all basitarsi, all tibiae except hind one beneath, mid femur at apex and a band along hind margin of outer surface, hind coxa beneath, flavous; fore trochanter black; pubescence as in male except golden on clypeus, hair on mesosternum sparse, and legs lacking the modified dense brushes present in male.

Head in frontal view subquadrate, its greatest width one-fifth more than height from apex of clypeus to top of eye; mandible tridentate apically and with a small tooth at middle of inner margin; clypeus with median longitudinal ridge slightly broadened toward tip, the apical margin bidentate in middle and thickened; scape unicarinate, but very feebly so, twice as long as interocular distance across antennal fossae; flagellum without tyloides; head from above subrectangular, the greatest width 1.5 times the length in middle; ocelli in a low triangle, the postocellar distance equal to ocellocular distance and twice the anterolateral ocellar distance; punctation of head similar to male except temple densely and more minutely so on upper two-thirds.

Thoracic sculpture similar to male, but pronotal tooth weaker.

Legs without the sexual modifications of male.

Sculpture of abdomen similar to male; pygidium strongly narrowed toward apex, excavate on apical two-thirds and fringed by stiff erect setae.

Female paratypes differ in no way except that one is 9.7 mm. long.

Paratypes: 1♀, 1♂; same data as type. 3♂♂; same data as type, but July 20, 1946. 2♀♀, 5♂♂; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler). 1♀, 1♂; Peleliu Island,

Palaus; July 23, 1946 (H. K. Townes). One female and two male paratypes will be deposited in the B. P. Bishop Museum, Honolulu.

**Dasyproctus immaculatus,** new species

*Rhopalum* (?) sp. Townes, 1946. Rpt. **14,** U. S. Comm. Co. Surv. Micronesia, p. 51 [common in the Palaus].

The combination of the rather short petiole of first abdominal segment, transverse carina margining the facial concavity above, and the total absence of yellow maculations on body and appendages serves to separate *immaculatus* from the other known species of this genus. It is not at all closely related to *Dasyproctus philippinensis* Ashmead, its closest geographical relative, which has coarse punctures on upper part of front and vertex, a longer, more slender first abdominal segment, and extensive yellow maculations on body and appendages.

Nothing is known of the ethology of this species, but other members of the genus nest in flower stalks or old beetle borings, and provision them with adult Diptera.

Type: ♂ ; northeast corner of Koror Island, Palaus; July 20, 1946 (H. K. Townes). [U. S. National Museum, Type No. 59036].

*Male*—Length 6.7 mm., forewing 5.0 mm. Black, dull, mat, with greenish reflections, except postscutellum, metapleuron and propodeum shining. Vestiture silvery; dense, short and decumbent on clypeus and facial concavity, sparser, longer and erect on rest of body. Wings slightly infumated, nervures fuscous.

Head in frontal view with greatest width 1.74 times the distance from apex of clypeus to carina margining facial concavity above; clypeus with median ridge well-developed, extending almost to apical margin, the median produced part of clypeus narrow, slightly emarginate at apex; carina margining facial concavity crenulate posteriorly; head viewed from above subrectangular, the greatest width 1.5 times the distance from occiput to carina margining the facial concavity; ocelli in a low triangle, the postocellar distance slightly less than ocellocular distance; front with a delicate carina running from anterior ocellus to carina margining facial concavity, with scattered, minute punctures which are about twice as dense as those on vertex; temple near lower eye margin with a few short oblique carinae and also a strong ridge curving upward from posterior mandibular condyle and extending about one-third the height of temple; occipital carina well developed, foveate anteriorly on side and beneath head; pedicel and flagellum of antenna about twice the length of scape, flagellar segments two to eleven with tyloides beneath which are linear on the first two and ultimate one, broadened on the others.

Pronotum with anterior transverse carina weak, present only on lateral fourth, the pronotum deeply notched in middle; mesoscutum, mesopleuron and scutellum with scattered minute punctures, the latter coarsely foveate posteriorly; postscutellum with coarse, longitudinal carinae; metapleuron with a few strong, oblique carinae; propodeum with a narrow, median longitudinal furrow on dorsal and posterior surfaces, the dorsal surface with radiating ridges, the posterior surface with transverse ridges, the lateral surface margined above and behind by a strong carina and with numerous fine, oblique carinae on disk.

Legs without sexual modifications.

Forewing with marginal cell slightly over 3 times as long as wide; second abscissa of radius slightly longer than first; second abscissa of cubitus half the length of the first, the latter subequal to transverse cubitus.

Abdomen with first segment petiolate anteriorly, short, about 1.25 times the length of hind tibia, the petiole subequal in length to the gradually widened, moderately nodose posterior part, the width at apex about half the length of the segment, the petiole shining and rugulosopunctate, the nodose posterior section sparsely and minutely punctate as are tergites two to six; last tergite rather coarsely punctate, a vestigial pygidial area indicated by a short lateral carina on apical fourth; sternites unmodified, practically impunctate, the last sternite truncate apically.

The male paratypes vary in no essential detail from the above description.

Allotype: ♀ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler). [U. S. National Museum].

*Female*—Length 8.7 mm., forewing 5.9 mm. Essential details as in male, with the following exceptions: Metapleuron and propodeum dull, but not mat; sternum of abdomen shining. Punctation as fine as in male, but everywhere correspondingly somewhat denser.

Head viewed from above with greatest width 1.73 times the median length from occiput to carina margining facial concavity; lower third of temple with six to eight oblique carinae running between eye margin and ridge from posterior mandibular condyle.

Thorax with posterior part of scutellum with short longitudinal carinae, not foveate; posterior surface of propodeum with carinae longitudinal, instead of transverse.

Abdomen with pygidium excavate, punctate at base, strongly narrowed toward apex, fringed laterally by stiff erect setae.

The female paratype is 9.0 mm. long and agrees in all details of sculpture with the allotype.

Paratypes: 2 ♂ ♂ ; northeast corner of Koror Island, Palaus; July 22, 1946 (H. K. Townes). 1 ♀ ; same data as allotype (KLM). One male paratype will be deposited in the B. P. Bishop Museum, Honolulu.

**Tachysphex bengalensis** Cameron

*Tachysphex bengalensis* Cameron, 1889. Mem. Proc. Manch. Lit. Phil. Soc. (4) **2**: 144 [ ♀ ; Tirhoot, India; type in London].

*Tachysphex* sp. Townes, 1946. Rpt. **14,** U. S. Comm. Co. Surv. Micronesia, p. 50 [Palaus].

The present species is widely distributed in the Oriental region and recently has become established in Hawaii (Weber, 1948. Proc. Hawaii. Ent. Soc. **13**: 203—erroneously reported as *bituberculatus* Cameron). The populations in the Palaus, Marianas and Hawaii probably originated from specimens introduced from the Philippines.

The habits of this species are unknown, but other members of the genus construct shallow burrows, usually in sandy soil, which they provision with Orthoptera.

MARIANA ISLANDS: 1 ♀ , 2 ♂ ♂ ; Susupe, Saipan; January 1, 1948 (K. L. Maehler).

CAROLINE ISLANDS: 1 ♀ ; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes).

**Dicranorhina** species

F. X. Williams informs me that he observed several specimens belonging to this genus running in a characteristic high-legged fashion near his quarters while in the Palaus in June 1948. He describes the manner of running (1928. Bul. **19,** Ent. Ser., Expt. Sta. Hawaii. Sugar Pl. Assoc., p. 100) in *luzonensis* Rohwer as "a peculiar easy gait, the fore part of the body being raised considerably higher than the posterior." It is unlikely that an endemic species would have escaped capture by the several expeditions which visited the Palaus from 1936 to 1946 because of the semi-domiciliary habits of the known species, so it seems probable that the species seen by Williams is a recent introduction to the Palaus, perhaps *luzonensis* Rohwer.

**Motes subtesselatus** (Smith)

*Larrada subtesselata* Smith, 1856. Cat. Hym. Brit. Mus. **4**: 277 [♀ ; India, Sumatra, Java; type in London].

*Notogonia manilensis* Rohwer, 1910. Proc. U. S. Natl. Mus. **37**: 659 [♂ ; Manila, Luzon, Philippines; type in Washington]. New synonymy.

*Notogonidea luzonensis* Rohwer, 1919. Bul. **14,** Ent. Ser., Expt. Sta. Hawaii. Sugar Pl. Assoc. p. 9 [♀ ; Los Baños, Luzon, Philippines; type in Washington].

*Motes subtesselatus* (Smith) Townes, 1946. Rpt. **14,** U. S. Comm. Co. Surv. Micronesia, p. 50 [Kwajalein].

Williams, 1928 (Bul. **19,** Ent. Ser., Expt. Sta. Hawaii. Sugar Pl. Assoc., p. 73), synonymizes *manilensis* (Rohwer) with *laboriosus* (Smith). An examination of the type shows that this is incorrect. Rohwer's type is a male of *subtesselatus* (Smith) and agrees with the characters cited in the foregoing key as well as those ascribed to *subtesselatus* by Williams (*loc. cit.*, pp. 70, 73). Williams (*loc. cit.*) is the authority for the other synonymy given above.

This common and widely distributed Oriental species was introduced into Hawaii from the Philippines over 25 years ago. Presumably the Marshall Islands population arose from specimens accidentally introduced there from Hawaii.

This species constructs tunnels in the soil and provisions the cells with crickets (Gryllidae).

MARSHALL ISLANDS: 1 ♀ ; no other locality; 1932 (on coconut flowers). 1 ♂ ; Kwajalein Island, Kwajalein Atoll; August 17, 1946 (H. K. Townes). 1 ♂ ; Kwajalein Island, November 2, 1946 (on leaves of *Wedelia biflora*).

**Motes laboriosus** (Smith), new combination

*Larrada laboriosa* Smith, 1856. Cat. Hym. Brit. Mus. **4**: 278 [♀ ; Philippines; type in London].

*Notogonia crawfordi* Rohwer, 1910. Proc. U. S. Natl. Mus. **37**: 659 [ ♀ ; Manila, Luzon, Philippines; type in Washington].

This is another common and widely distributed Oriental species probably established in the Marianas by way of the Philippines. Williams, 1928 (Bul. **19,** Ent. Ser., Expt. Sta. Hawaii. Sugar. Pl. Assoc., p. 73) is the authority for the above synonymy. The records from Micronesia are as follows:

MARIANA ISLANDS: 1 ♀ ; Hagoya Lake, Tinian; June 10, 1946 (H. K. Townes). 3 ♀ ♀ ; Tinian; June 13, 1946 (H. K. Townes). 1 ♀ ; Susupe, Saipan; January 1, 1948 (K L. Maehler). 1 ♀ ; Agricultural Farm, Guam; February 28, 1948 (K. L. Maehler). 1 ♂ ; Piti, Guam; March 13, 1948 (K. L. Maehler; on *Ipomoea*).

**Motes manilae** (Ashmead)

*Notogonia manilae* Ashmead, 1905. Proc. U. S. Natl. Mus. **28**: 130 [ ♀ , ♂ ; Manila, Luzon, Philippines; type in Washington].

*Notogonia retiaria* Turner, 1908 Proc. Zool. Soc. London, p. 479 [ ♀ ; Perth, Australia; type in London].

*Notogonidea williamsi* Rohwer, 1919. Bul. **14,** Ent. Ser., Hawaii. Sugar Pl. Assoc., p. 9 [ ♀ ; Los Baños, Luzon, Philippines; type in Washington].

*Motes manilae* (Ashmead) Yasumatsu, 1941. Mushi **14**: 44 [ ♀ from Pagan Island, Marianas; ♂ from Babelthuap Island, Palaus].—Towns, 1946. Rept. **14,** U. S. Comm. Co. Surv. Micronesia, p. 50 [Guam].

*Notogonidea manilae* (Ashmead) Swezey, 1942. B. P. Bishop Mus. Bul. **172**: 184 [Guam].

Williams, 1928 (Bul. **19,** Ent. Ser., Expt. Sta. Hawaii. Sugar Pl. Assoc., p. 75), and 1945 (Proc. Hawaii. Ent. Soc. **12**: 444) is the authority for the above synonymy. *M. manilae* is widely distributed in the Oriental and Australasian regions and is present on many of the Pacific islands. It nests in the soil and provisions the cells with small crickets (*Nemobius*).

MARIANA ISLANDS: 1 ♀ ; U S. Commercial Co. Farm, Saipan; June 17, 1946 (R. G. Oakley). 1 ♀ ; Mt. Santa Rosa, Guam; February 26, 1948 (K. L. Maehler). 1 ♀ ; same, but March 12, 1948. 1 ♂ ; Dededo, Guam; April 8, 1948 (K. L. Maehler). 1 ♂ ; Agaña, Guam; December 17, 1947 (K. L. Maehler). 1 ♀ ; same, but February 22, 1948 (on *Ipomoea*). 2 ♀ ♀ ; same, but March 10, 1948 (on *Passiflora foetida*). 1 ♀ ; Agaña airport, Guam; June 13, 1946 (H. K. Townes). 1 ♀ ; same, but May 26, 1948 (K. L. Maehler). 1 ♂ ; same, but May 23, 1948 (on *Ipomoea*). 1 ♀ ; Mt. Alutom, Guam; June 6, 1946 (H. K. Townes). 1 ♂ ; Yona, Guam; November 18, 1937 (R. G. Oakley). 1 ♂ ; Ylig, Guam; December 14, 1947 (K. L. Maehler; on *Scaevola*).

1 ♀ ; Talofofo, Guam; December 19, 1947 (K. L. Maehler). 1 ♀ ; Haputo Point, Guam; April 27, 1948 (K. L. Maehler). 1 ♀ ; Guam; 1937 (R. G. Oakley). 1 ♂ ; Tumon Bay, Guam; April 27, 1948 (K. L. Maehler).

CAROLINE ISLANDS: 1 ♂ ; Fefan Island, Truk Atoll; May 27, 1946 (H. K. Townes). 2 ♀ ♀ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler) [KLM].

**Motes townesi,**[6] new species

*Motes* sp. Townes, 1946. Rpt. **14,** U. S. Comm. Co. Surv. Micronesia, p. 50 [Palaus].

The present species belongs to the difficult complex containing *manilae* (Ashmead), *tristis* (Smith), *samoensis* (Williams), *bakeri* (Williams), *ligulata* (Williams) and others. It is at once separable from all of them by the extremely sparse thoracic punctation. Apparently it is closest to *samoensis,* which differs in the male in genitalic features and shorter basal flagellar segments, in the female in the lack of silvery bands on abdomen, and in both sexes in the denser punctation of the thorax. Like *samoensis, townesi* is larger ( ♀ , 9.2 mm.; ♂ , 8.5 mm.) than the ubiquitous *manilae* ( ♀ , 6.5-8.3 mm.; ♂ , 5.0-6.5 mm.).

Type: ♀ ; Arakabesan Island, Palaus; July 18, 1946 (H. K. Townes). [U. S. National Museum, Type No. 59037.]

*Female*—Length 9.2 mm., forewing 6.7 mm. Black, shining; middle of mandible castaneous. Vestiture sparse, inconspicuous, short, fine silvery, mostly appressed on head, legs and abdomen, suberect on thorax; first three abdominal tergites with silvery bands on apical fourth; pygidium with short, dense, appressed silvery pubescence and scattered, long, fine suberect bristles. Wings slightly infumated and with iridescent reflections, veins fuscous.

Head: Produced part of clypeus with a shallow emargination in middle and no lateral notch, the bevel extending across apical third and with scattered punctures; front and vertex with delicate punctures, those on front separated by at least the width of a puncture, those on vertex denser, the callosities along inner eye margin impunctate, delicately shagreened; the least interocular distance on vertex 1.3 times the length of the first flagellar segment, the first two flagellar segments subequal in length.

Thorax: Mesoscutum with moderately large punctures many of which are separated by the width of a puncture (all subcontiguous in *manilae*); scutellum with finer punctures separated by several times the width of a puncture; postscutellum equally finely punctate, but more closely so; mesopleuron with extremely scattered, fine punctures; dorsum of propodeum regularly rugulosopunctate, formed chiefly from suboblique rugulae, the median longitudinal carina present only on basal half; posterior surface with fine transverse carinae, the central sulcus with raised margins which diverge strongly above in an arched line near dorsum.

Abdomen: Pygidium with sides slightly convex, the basal width about six-sevenths the length.

Wings: Marginal cell obliquely truncate, the relative lengths of the abscissae about 7:3:3:8:3.

Allotype: ♂ ; same data as type. [U. S. National Museum.]

[6] For H. K. Townes, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, in recognition of his diligent and thorough collecting in Micronesia.

*Male*—Length 8.5 mm., forewing 6.4 mm. Similar to female in color and vestiture, the punctation correspondingly somewhat denser.

Head: Apical margin of produced part of clypeus evenly rounded, not notched; scape plus first flagellar segment subequal to least interocular distance on vertex, the first flagellar segment slightly less than twice as long as width at apex.

Wings: Relative lengths of abscissae of marginal cell about 7:2:3:8:3.

Genitalia: Paramere similar in shape to *samoensis*, the apical half relatively narrower; in *manilae* the paramere is abruptly narrowed halfway to tip, but is rather evenly narrowed in *townesi* and *samoensis;* in *townesi* the bristles along outer margin of paramere at middle are denser than in *manilae*.

**Liris opulenta** (Lepeletier)

*Sphex aurata* Fabricius, 1787. Mant. Ins. **1**: 276 [East Indies; type in Kiel (?); preoccupied by Linnaeus, 1758].

*Tachytes opulenta* Lepeletier, 1845. Hist. Nat. Ins. Hym. **3**: 246 [♀, ♂; Java; type in Paris].

*Liris aurata* (Fabricius) Yasumatsu, 1937. Mushi **9**: 129 [Saipan Island, Marianas]. — Yasumatsu, 1940. Akitu **2**: 184 [Pagan Island, Marianas].—Yasumatsu, 1941. Mushi **14**: 45 [♀, ♂; Marianas].—Swezey, 1942. B. P. Bishop Mus. Bul. **172**: 184 [records from Guam].—Townes, 1946. Rpt. **14**, U. S. Comm. Co. Surv. Micronesia, p. 50 [Kwajalein, Marianas, Truk, Palaus].

This handsome wasp is widely distributed in the Ethiopian and Oriental regions and has become established on many of the Pacific islands including Hawaii (Weber, 1947. Proc. Hawaii. Ent. Soc. **13**: 22). Richards, 1935 (Trans. Roy. Ent. Soc. London **83**: 164), has pointed out that the Fabrician *Sphex aurata* was preoccupied by Linnaeus, and that the Fabrician species probably should be known as *opulenta* (Lepeletier). It has been recorded as nesting in the soil and storing large crickets (Gryllidae).

MARSHALL ISLANDS: 1♀; Kwajalein Island, Kwajalein Atoll; August 16, 1946 (H. K. Townes). 3♂♂; same data, but August 17, 1946. 2♂♂; same data, August 17, 1946 (R. G. Oakley).

MARIANA ISLANDS: 4♀♀; Guam; 1937 (R. G. Oakley). 1♀; Com Mar Hill, Guam; January 10, 1948 (K. L. Maehler). 1♀; Tinian; June 9, 1946 (H. K. Townes). 1♂; same data, but June 13, 1946 (H. K. Townes).

CAROLINE ISLANDS: 1♂; Moen Island, Truk Atoll; May 31, 1946 (H. K. Townes; possibly preys on *Conocephalus* or *Anaxipha* [Orthoptera]). 1♀; same data, but June 30, 1946 (K. J. Pelzer). Townes states that it was common also on Dublon Island, Truk Atoll, but no specimens were taken. 2♂♂; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes).

**Liris esakii** Yasumatsu

*Liris esakii* Yasumatsu, 1941. Mushi **14**: 46, pl. 1, figs. 1-3 [♀, ♂; Yap, Truk; type in Fukuoka, Japan].

This species is readily distinguished from the other Micronesian *Liris* by the combination of the strongly infumated wings, the sparser punctation of the mesoscutum, the radiating carinae on the dorsum of the propodeum, the dark brown pile on the female pygidium, and the almost total lack of carinae on the lateral surface of the propodeum of the male. Yasumatsu shows the male clypeus as having the margin of the produced part shallowly concave and without a central notch. My two males have a central notch, and the margin is subtruncate in one, and convex on each side of the central notch in the other, so there is considerable variation in this character.

CAROLINE ISLANDS: 2 ♀ ♀, 1 ♂; Moen Island, Truk Atoll; February 6, 1948 (K. L. Maehler). 1 ♂; same data, but February 7, 1948 (K. L. Maehler; in field). 1 ♂; Dublon Island, Truk Atoll; February 10, 1948 (K. L. Maehler; in field). 1 ♀; same date, but February 11, 1948. 1 ♀; Nif-Guilifez, Yap Island; September 7, 1939 (T. Esaki)—paratype.

**Liris samoensis** Williams

*Liris samoensis* Williams, 1928. Ins. Samoa, Hym., Pt. 5, Fasc. 1, p. 36, text figs. 10-12 [♀, ♂; Samoa; type in London].—Yasumatsu, 1941. Mushi **14**: 45, pl. 1, fig. 4 [Ponape].

Yasumatsu records a single male from Ponape as this species. He states that the occipital carina is angulate lateroventrally instead of rounded as in other species of the genus. The Ponape specimen was not compared with Samoan material, and there is some possibility that the Ponape form is at least subspecifically distinct. The female of the Samoan form has the pygidial pile pale golden, which readily distinguishes it from the closely related *esakii* and *williamsi* which have dark brown pile on the pygidium. I have seen no material from Ponape, and the species is included in the key on the basis of a pair of paratypes made available by E. C. Zimmerman and R. H. Van Zwaluwenburg.

**Liris williamsi,**[7] new species

The present species is most closely related to *esakii* Yasumatsu. In addition to the hyaline wings and weaker oblique carinae on the dorsum of the propodeum, *williamsi* is separated from *esakii* by the relatively denser punctation of the mesoscutum and the better developed shoulder below the lateral angle of the produced part of the clypeus. This species is endemic in the Palaus.

Type: ♀; northeast corner of Koror Island, Palaus; July 22, 1946 (H. K. Townes). [U. S. National Museum, Type No. 59038.]

*Female*—Length 10.8 mm., forewing 9.2 mm. Black, head and thorax opaque, abdomen rather shining; tip of mandible castaneous. Vestiture rather sparse, very inconspicuous, fine, and silvery, appressed and rather dense on

[7] For F. X. Williams, formerly of the Hawaiian Sugar Planters' Association, in recognition of his many useful contributions to our knowledge of the wasps of Oceania.

clypeus and lower half of front, sparser and appressed on thorax, legs and abdomen, the thorax in addition with some longer, suberect hairs, first three abdominal tergites with a short, narrow strip of appressed silvery pubescence laterally at apex; pygidium with dense, short, appressed dark brown hairs, and a few suberect bristles. Wings hyaline and with iridescent reflections, the apices slightly infuscated, nervures black.

Head: Clypeus punctate almost to apical margin, the latter with a narrow median notch, and a small shoulder at lateral angle of produced part, the margin between notch and shoulder slightly convex, the apical third of clypeus shining and with larger punctures than the basal two-thirds which is dull from close, fine punctation; first and second flagellar segments subequal in length, the least interocular distance on vertex 1.13 times the length of the first flagellar segment.

Thorax: Mesoscutum with moderately large punctures, anteriorly somewhat closer than on the posterior three-fourths where they are separated by about the width of a puncture; scutellum with smaller punctures separated by about twice the width of a puncture; postscutellum more finely and rather closely punctate; mesopleuron shagreened; dorsal surface of propodeum with a well-defined shallow central sulcus which encloses a carina on basal half, elsewhere with weak, irregular oblique carinae; side of propodeum with a few oblique carinae on anterior half; posterior surface of propodeum with a narrow, impressed median line, above with a couple irregular transverse carinae, elsewhere scabrous.

Abdomen: Pygidium with sides slightly convex, the basal width about three-fifths the length.

Wings: Relative lengths of abscissae of marginal cell of forewing about 9:3:5:11:2.

Paratype: ♀; Koror, Palau Islands; March 15-25, 1948 (K. L. Maehler; in field). It is 10.5 mm. long and differs from the type in lacking a central carina on basal half of dorsum of propodeum. The paratype will be deposited in the B. P. Bishop Museum, Honolulu.

**Liris (?) mindanaoensis carolinensis** Yasumatsu

*Liris mindanaoensis carolinensis* Yasumatsu, 1941. Mushi **14**: 46, pl. 1, fig. 5 [♂; Tol Island, Truk Atoll; type in Fukuoka, Japan].

I have had to omit this form from the key because of lack of material and a suspicion that it may be placed in the incorrect genus. The measurements given by Yasumatsu (length: head 2.5 mm.; forewing 2.0 mm.; hind wing 1.5 mm. Width: head 1.5 mm.; thorax 2.0 mm.; abdomen 1.5 mm.) indicate a larrine wasp much smaller than any I have seen from Micronesia. Even the tiniest male *Motes manilae* (body length 5.0 mm.) known to me has a forewing 4.0 mm. in length. The known species of *Liris* are all much larger, no Micronesian males being less than 7.0 mm. long (forewing 6.0 mm.). Certainly if *carolinensis* is a true *Liris* it is specifically distinct from *mindanaoensis* which is almost as large as *opulenta*.

**Solierella rohweri** (Bridwell)

*Silaon rohweri* Bridwell, 1920. Proc. Hawaii. Ent. Soc. **4**: 398, fig. [♀, ♂; Oahu; type in Honolulu].

This species, which nests in abandoned beetle borings in *Euphorbia* in Hawaii and provisions the nests with nymphs of *Nysius* (Lygaeidae), is apparently a recent migrant to the Marshalls. In the discussion accompanying the original description Bridwell suggests that the species may have been introduced into Hawaii, possibly from Central America. Krauss, 1945 (Proc. Hawaii. Ent. Soc. **12**: 317), made the above generic transfer.

MARSHALL ISLANDS: 1 ♂ ; Engebi Island, Eniwetok Atoll; May 18, 1946 (H. K. Townes and R. G. Oakley).

**Trypoxylon philippinense** Ashmead

*Trypoxylon philippinensis* Ashmead, 1904. Canad. Ent. **36**: 283 [ ♂ ; Manila, Luzon, Philippines; type in Washington].

This Philippine species was established in Hawaii as early as 1914 (Swezey, 1915. Proc. Hawaii. Ent. Soc. **3**: 86). Swezey reports that it builds clay cells in sheltered situations and provisions them with spiders. The specimen listed below was collected on Guam, but apparently may not have become established for it has not been taken in recent years.

MARIANA ISLANDS: 1 ♀ ; Root Farm, Guam; August 25, 1938 (R. G. Oakley; flying in office).

**Pison punctifrons** Shuckard

*Pison punctifrons* Shuckard, 1837. Trans. Ent. Soc. London **2**: *77* [ ♀ ; India or St. Helena; type in Oxford].—Yasumatsu 1937. Mushi **9**: 134 [ ♀ ; Palaus]. — Yasumatsu, 1939. Festschr. 60 Geburtst. E. Strand **5**: 83.

*Pison suspiciosus* Smith, 1858. Jour. Proc. Linn. Soc. Zool. **2**: 104 [ ♀ ; Singapore; type in Oxford].

*Pison fabricator* Smith, 1869. Trans. Ent. Soc. London, p. 297 [ ♀ ; Hong Kong; type in London].

*Pison striolatum* Cameron, 1896. Mem. Manch. Lit. Phil. Soc. **41**: 82 [ ♀ ; Mussouri; type in Oxford].

*Pison lagunae* Ashmead, 1904. Proc. U. S. Natl. Mus. **28**: 131 [ ♂ ; Laguna de Bay, Luzon, Philippines; type in Washington].—Swezey, 1942. B. P. Bishop Mus. Bul. **172**: 185 [records from Guam]. New synonymy.

*Pison javanus* Cameron, 1905. Tijd. f. Ent. **48**: 63 [ ♂ ; Java; type in Amsterdam].

*Pison* sp. Fullaway, 1913. Hawaii. Ent. Soc., Proc. **2**: 283 [Guam].

The above synonymy is based on Turner, 1916 (Proc. Zool. Soc. London, p. 625, sp. 81), except that *lagunae* Ashmead, of which I have seen the type, is also placed in synonymy. Turner had treated the latter as a possible synonym (*loc. cit.*, sp. 83). This is one of the most widely distributed and easily recognized *Pison* occurring in Micronesia. It is not an endemic species.

The species constructs either free clay cells or partitions holes in timber and provisions the cells with small spiders.

MARSHALL ISLANDS: 1 ♂ ; Japtan Island, Eniwetok Atoll; May 15, 1946 (H. K. Townes).

MARIANA ISLANDS: 1 ♀ ; Agrihan Island; August 6, 1945 (D. J. Borror). 1 ♀ ; same data, but August 7, 1945. 2 ♀ ♀ ; Saipan; June 28, 1946 (H. K. Townes). 1 ♀ ; same data, but December 20, 1944 (Smith). 1 ♂ ; Tinian; June 9, 1946 (H. K. Townes). 1 ♂ ; same data, but June 11, 1946 (R. G. Oakley). 1 ♀ , 1 ♂ ; Hagoya Lake, Tinian; June 10, 1946 (H. K. Townes). 1 ♀ , 3 ♂ ♂ ; Guam (D. T. Fullaway). 2 ♂ ♂ ; Agaña, Guam; December 15, 1947 (K. L. Maehler; on *Thespesia populnea*). 1 ♀ , 1 ♂ ; same data, but December 17, 1947. 1 ♂ ; Point Oca, Guam; July 1945 (J. L. Gressitt and G. E. Bohart).

CAROLINE ISLANDS: 1 ♂ ; Machiro Island, Kapingamarangi Atoll; August 4, 1946 (H. K. Townes). 1 ♀ ; near Yaptown, Yap Island; July 14, 1946 (H. K. Townes). 1 ♂ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler). 1 ♀ , 2 ♂ ; Melekeiok, Babelthuap Island, Palaus; April 7, 1936 (Z. Ono) [BPB]. 1 ♂ ; Ogiwal, Babelthuap Island, Palaus; April 10, 1936 (Z. Ono) [BPB].

**Pison esakii** Yasumatsu

*Pison* sp. Fullaway, 1913. Proc. Hawaii. Ent. Soc. **2**: 283 [Guam].—Swezey, 1942. B. P. Bishop Mus. Bul. **172**: 185 [Guam].

*Pison esakii* Yasumatsu, 1937. Mushi **9**: 129, fig. [ ♀ ; Rota; type in Fukuoka].

*Pison Esakii* Yasumatsu, 1939. Festchr. 60 Geburtst. E. Strand **5**: 83.

The strongly infumated wings and erect black hairs on head and thorax readily separate this handsome wasp, endemic in the Marianas, from all others in Micronesia. Peculiarly enough the male is still unknown, though it should be easily recognized, since it probably has the same characters of coloration and pubescence. The species is rare in collections and I suspect must be a sylvicolous species.

MARIANA ISLANDS: 1 ♀ ; Guam (D. T. Fullaway). 1 ♀ ; Point Ritidian, Guam; April 16, 1936 (E. H. Bryan, Jr.). 1 ♀ ; same data, but June 1945 (J. L. Gressitt). 1 ♀ ; Piti, Guam; June 12, 1936 (O. H. Swezey; at light). 2 ♀ ♀ ; Mt. Alifan, Guam; June 27, 1936 (O. H. Swezey). 1 ♀ ; Tinian; June 9, 1946 (H. K. Townes). Occurs also on Rota (type locality).

**Pison nigellum,** new species

The present species, endemic on Ponape, is the only Micronesian *Pison* except the Guam *esakii* with erect black pubescence on the

head and thorax. It differs from *esakii, inter alia,* in the smaller size, the more or less pentagonal clypeal lobe, details of the propodeal sculpture and hyaline wings.

Type: ♀ ; near hydroelectric plant, Colonia, Ponape; August 9, 1946 (H. K. Townes; along roads, stream banks and bottomland native vegetation). [U. S. National Museum, Type No. 59039.]

*Female*—Length 8.0 mm., forewing 6.2 mm. Black, head opaque, thorax and abdomen shining; mandible castaneous near tip. Erect vestiture short, black, moderately dense on head and thorax, very sparse on abdomen; clypeus and lower half of front with appressed, short, dense silvery pubescence, abdomen with much sparser, shorter appressed silvery hairs and without apical hair-bands; tibial calcaria black. Wings hyaline and with iridescent reflections, stigma and veins black.

Head: Clypeal lobe impunctate, more or less pentagonal in outline, about one-third the greatest width of clypeus; front finely granulate and with superimposed small, shallow punctures mostly separated by somewhat more than the diameter of a puncture; an evanescent longitudinal groove running from anterior ocellus half the distance toward antennal insertions and terminating in a short polished streak; vertex about as finely punctate as front, but the punctures separated by about the diameter of a puncture; shortest distance between eyes at lower ends (across middle of clypeus) 2.2 times the shortest interocular distance on vertex; ocellocular distance one-sixth the diameter of a posterior ocellus and one-fourth the postocellar distance; ratio of lengths of first three segments of flagellum about 13:12:12; least interocular distance on vertex equal to length of first flagellar segment.

Thorax: Mesoscutum with punctures equal in size to those on front, anteriorly separated by about the diameter of a puncture, posteriorly by more than the diameter of a puncture; scutellum and postscutellum with finer, more separated punctures; mesopleuron with punctures equal in size to those on mesoscutum, usually separated by somewhat more than the diameter of a puncture; metapleuron with minute punctures, those on upper third closer together; dorsum of propodeum with sparse, minute punctures, a few very short radiating carinae at base, the median longitudinal carina weak, extending over anterior half only, contained in a very shallow sulcus which is deeper posteriorly; lateral surface of propodeum with minute punctures which are closer than on dorsum, no carina separating lateral from dorsal and posterior surfaces; the latter with the usual deep impression in middle, some scattered fine punctures and above insertion of muscle a few short, transverse carinae interrupted at midline.

Abdomen: Tergites with minute scattered punctures, the first five very slightly constricted at apex; second sternite practically impunctate.

Wings: Forewing with petiole of second submarginal cell 1.4 times the height of cell; first recurrent vein interstitial with first transverse cubital vein, the second slightly distad of the second transverse cubital.

Female paratypes vary in length from 7.0 to 8.5 mm., and differ from the above description in no important details, except that occasionally the first recurrent vein in the forewing is received proximad of the first transverse cubital vein.

Allotype: ♂ ; Ponape; March 14, 1936 (Z. Ono). [B. P. Bishop Museum.]

*Male.* Length 7.2 mm., forewing 5.4 mm. Similar to the type in color, vestiture and sculptural characters with the following exceptions.

Head: Clypeal lobe pentagonal in shape, but the apex more narrowly rounded; shortest distance between eyes at lower ends (across middle of

clypeus) 1.7 times the shortest interocular distance on vertex: ocellocular distance about one-third the diameter of a posterior ocellus and one-half the postocellar distance; least interocular distance on vertex about 1.5 times the length of the first flagellar segment.

Thorax: Punctation correspondingly somewhat sparser than in female.

Abdomen: Third sternite without a median tubercle or ridge; second to fifth sternites with low, rounded, transverse, posterolateral ridges, those of third the longest and strongest, those of fifth very short; hypopygium with surface flat, clothed with stout bristles on exposed part, the apical margin truncate.

Wings: First recurrent vein slightly proximad of first transverse cubital vein, second recurrent slightly distad of second transverse cubital.

Paratypes: 1 ♀; same data as type [USNM]. 1 ♀; Kolonie, Ponape; February 2, 1936 (Z. Ono). 5 ♀ ♀; Ronkiti, Ponape; February 4, 1936 (Z. Ono). 1 ♀; Wone, Ponape; February 11, 1936 (Z. Ono). 3 ♀ ♀; Roi, Ponape; February 14, 1936 (Z. Ono). 1 ♀; Reitao, Ponape; March 1, 1936 (Z. Ono). 2 ♀ ♀; Tamon-Reitao, Ponape; March 1, 1936 (Z. Ono). 7 ♀ ♀; Ponape; March 14, 1936 (Z. Ono) [BPB].

**Pison argentatum** Shuckard

*Pison* (*Pisonitus*) *argentatus* Shuckard, 1837. Trans. Ent. Soc. London **2**: 79 [♀; Mauritius; type in Oxford].

*Pison fuscipalpis* Cameron, 1901. Proc. Zool. Soc. London **2**: 27 [♀; Singapore; type in London].

*Pisonitus argenteus* Ashmead, 1904. Proc. U. S. Natl. Mus. **28**: 131 [♀; Bacoor, Philippines; type in Washington].

*Pison argentatum* Shuckard, Swezey, 1942. B. P. Bishop Mus. Bul. **172**: 185; [Guam; parasitized by *Melittobia;* stores small spiders].

The present species and *ignavum* Turner are easily distinguished from other *Pison* occurring in Micronesia by the pale tibial calcaria, extremely dense silvery pubescence and the second recurrent vein being received in the middle of the second submarginal cell. *P. argentatum* is smaller (aver. length, ♀-6 mm., ♂-5 mm.) than *ignavum* (aver. length, ♀-8 mm., ♂-7 mm.), the punctation is finer though equally dense, the apical margin of the clypeal lobe is not depressed in the middle in the female, and the oblique carinae on the dorsum of the propodeum are weaker and tend to become evanescent toward the margins. The present species is more widely distributed than any other *Pison*, occurring in the Ethiopian and Oriental regions, and on various Pacific islands east to Hawaii. It constructs free clay cells in sheltered situations which it provisions with small spiders.

MARIANA ISLANDS: 2 ♀ ♀, 3 ♂ ♂; Pago, Guam; May 9, 1945 (J. L. Gressitt and G. E. Bohart). 1 ♂; Talofofo, Guam; February 26, 1948 (K. L. Maehler).

CAROLINE ISLANDS: 1 ♀; Dublon Island, Truk Atoll;

February 10, 1948 (K. L. Maehler; reared from clay cells in church; parasitized by *Melittobia hawaiiensis* Perkins [Chalcididae]). 1 ♀ ; Ronkiti, Ponape; February 4, 1936 (Z. Ono) [BPB].

**Pison ignavum** Turner

*Pison ignavum* Turner, 1908. Proc. Zool. Soc. London, p. 511 [♀, ♂ ; Australia; type in London].

*Pison argentatum ignavum* Turner, 1916. Proc. Zool. Soc. London, p. 601 [recorded from Australia and Fiji].

The present species has been recorded from Australia, New Caledonia, Fiji, Society Islands, Samoa and the Marquesas. I agree with Williams, 1932 (B. P. Bishop Mus. Bul. **98**: 152-153) in treating it as a species distinct from, though uncomfortably close to, *argentatum* Shuckard. Like the latter, it builds free clay cells in sheltered situations which it provisions with small spiders.

CAROLINE ISLANDS: 1 ♂ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler).

**Pison hospes** Smith

*Pison hospes* Smith, 1879. Jour. Linn. Soc. Zool. **14**: 676 [♀, ♂ ; Hawaii; type in London].

*Pison fuscipennis* Smith, Yasumatsu, 1937. Mushi **9**: 131, pl. 10, figs. 3, 4 [♀, ♂ ; Palaus; misidentification of Smith species].—Yasumatsu, 1939. Festschr. 60 Geburtst. E. Strand **5**: 83.

*Pison palauensis* Yasumatsu, 1937. Mushi **9**: 133 [*nomen nudum* occurring in description of *Pison korrorensis*].

The comparatively large size, triangular clypeal lobe, and dense punctation of mesopleuron and second abdominal sternite distinguish the present species from others occurring in Micronesia. The Marshall Islands populations may have arisen from migrants from Hawaii. The species was present in the Palaus as early as 1936.

Yasumatsu's description and figures of what he calls *fuscipennis* Smith agree with specimens of the present species. The species does run to *fuscipennis* in Turner's table to the Australian species (1916, Proc. Zool. Soc. London, pp. 595-599), but *hospes* is not included in that key. Since Turner apparently knew both species and treated them as distinct I shall follow him. Turner does mention (*loc. cit.*) that *hospes* "is doubtfully distinct from *P. pallidipalpis* Smith." The latter name has precedence if the two are conspecific.

MARSHALL ISLANDS: 1 ♀, 1 ♂ ; Airek Island, Ailinglapalap Atoll; August 26, 1946 (H. K. Townes). 1 ♀ ; Imrodi Island, Jaluit Atoll; August 24, 1946 (H. K. Townes).

CAROLINE ISLANDS: 1 ♀, 1 ♂ ; Peleliu Island, Palaus (Z. Ono) [BPB]. 1 ♀ ; Peleliu Island, Palaus; July 23, 1946 (H. K.

Townes). 3 ♀ ♀ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler). 1 ♀ ; Palau Islands; April 8, 1936 (Z. Ono) [BPB]. 1 ♀ ; Airai, Palaus; April 17, 1936 (Z. Ono) [BPB].

**Pison tahitense** Saussure

*Pison tahitense* Saussure, 1867. Reise d. Novara, Zool. 2, Hym., p. 65 [♀, ♂ ; Tahiti; type in Geneva (?)].

*Pison Rechingeri* Kohl, 1908. Denkschr. Akad. Wiss. Wien **81**: 309 [♀, ♂ ; Samoa; type in Vienna (?)].

Apparently this is a recent introduction to Micronesia. Previously it was known from the Fijis, Samoa, Society Islands, Ellice Islands and the Marquesas. Its closest relatives in Micronesia are *hospes* and *ponape,* from which it may be distinguished by a combination of the infumated wings, well-developed median carina on dorsum of propodeum, and the sculpture of the posterior surface of the propodeum and second abdominal sternite.

MARSHALL ISLANDS: 1 ♀ ; Bigatyelang Island, Ailinglapalap Atoll; August 25, 1946 (H. K. Townes).

**Pison ponape,** new species

The present species, known from the female only, forms with *hospes* and *tahitense* a group rather well segregated from the other Micronesian species. The group is distinguished by the subcontiguous punctation of mesopleuron, lack of oblique carinae on dorsum of propodeum, unmodified third abdominal sternite of males, and the rather large size, females averaging over 9 mm. in length and the known males over 8 mm. In addition to the characters listed in the key as distinguishing *ponape* from *hospes* and *tahitense,* it has a prominent apical band of silvery pubescence on only the first tergite, whereas the latter two species have such bands on the first four tergites in the females.

Like *nigellum, ponape* appears to be an endemic species on Ponape and is found in areas of native vegetation.

Type: ♀ ; near hydroelectric plant, Colonia, Ponape; August 9, 1946 (H. K. Townes; along roads, stream banks and bottomland native vegetation). [U. S. National Museum, Type No. 59040.]

*Female.* Length 9.5 mm., forewing 7.5 mm. Black, head opaque, thorax and abdomen shining; apical half of mandible castaneous. Vestiture silvery (brownish on mesoscutum), short, suberect and moderately dense on clypeus and temples, short and erect on rest of head, longer and erect on thorax, short and decumbent on legs and abdomen, moderately dense on legs, very sparse on abdomen, only the first tergite with a noticeable apical band; tibial calcaria black. Wings clear hyaline and with iridescent reflections, stigma and veins black.

Head: Clypeal lobe impunctate, the apical margin rounded, about 0.4 times the greatest width of clypeus; front finely granulate and with superimposed small, shallow punctures separated by about the width of a puncture; frontal groove moderately well developed and extending from anterior ocellus half the distance toward antennal insertions and terminating in a very small tubercle; vertex about as finely punctate as front, but the punctures separated

by about half the diameter of a puncture; shortest distance between eyes at lower ends (across middle of clypeus) 1.9 times the shortest distance between eyes on vertex; ocellocular distance half the diameter of a posterior ocellus and about two-thirds the postocellar distance; relative lengths of first three flagellar segments about 13:11:11; least interocular distance on vertex slightly greater than length of first flagellar segment.

Thorax: Mesoscutum with punctures about twice as wide as on front, many of them separated by less than the diameter of a puncture; scutellum with smaller, somewhat sparser punctures; postscutellum with very small, dense punctures; mesopleuron with subcontiguous punctures equal in size to those on mesoscutum; metapleuron above with several close, longitudinal carinae, elsewhere with small, moderately dense punctures; lateral surface of propodeum separated from dorsal and posterior surfaces by a carina extending from near spiracle almost to apex of segment; dorsal surface with median carina absent, the median sulcus moderately deep, slightly widened toward apex, rest of surface with punctures slightly smaller than on mesoscutum, denser laterally; lateral surface with large, subcontiguous punctures; posterior surface with the usual deep impression on upper half, punctate laterad of this impression, the lower half impunctate and with four strong transverse rugae.

Abdomen: Tergites with minute, rather dense punctures, the second to fifth slightly constricted at apex; second to fifth sternites with slightly larger punctures, those on second separated by several times the diameter of a puncture, those on succeeding sternites progressively more closely punctate.

Wings: Forewing with petiole of second submarginal cell 1.3 times the height of cell; first recurrent vein received near apex of first submarginal cell, second recurrent interstitial with second transverse cubital vein.

Female paratypes vary in length from 9.0 to 10.5 mm. and differ from the above description as follows: Two have the frontal tubercle a short Y-shaped process; first recurrent vein of forewing is interstitial with first transverse cubital vein in one specimen; one specimen, probably a callow, has the hind legs and abdomen castaneous; and the number of strong transverse rugae on the posterior surface of the propodeum varies from four to six.

Paratypes: 1 ♀ ; same data as type, but August 13, 1946 (H. K. Townes) [USNM]. 1 ♀ ; Choptokoi, Ponape; February 10, 1936 (Z. Ono). 1 ♀ ; Tolocolme, Ponape; February 15, 1936 (Z. Ono). 1 ♀ ; Tamon, Ponape; February 27, 1936 (Z. Ono). 1 ♀ ; Tamon-Reitao, Ponape; March 1, 1936 (Z. Ono). 1 ♀ ; Ponape; March 14, 1936 (Z. Ono) [BPB].

**Pison oakleyi,**[8] new species

*Pison* sp. Fullaway, 1913. Proc. Hawaii. Ent. Soc. 2:283 [Guam].—Swezey, 1942. B. P. Bishop Mus. Bul. 172:185 [Guam].

The shining, nonshagreened interspaces on the mesopleuron, strongly infumated wings and low rounded tubercle near middle of third abdominal sternite of male readily distinguish the present

[8] For R. G. Oakley, Division of Foreign Plant Quarantine, Bureau of Entomology and Plant Quarantine, whose collecting on crop plants in Micronesia forms an important supplement to the material collected by H. K. Townes on native vegetation.

form from the closely related *iridipenne* and *korrorense*. Like the other endemic Micronesian *Pison, ponape, nigellum,* and *esakii,* this is an inhabitant of the native forests.

Type: ♂ ; Point Ritidian, Guam; June 1945 (J. L. Gressitt). [U. S. National Museum, Type No. 59041.]

*Male.* Length 6.1 mm., forewing 4.9 mm. Black, shining except head opaque; mandible at tip castaneous. Vestiture sparse, silvery, shining, less noticeable than in *iridipenne,* decumbent on head, legs and abdomen, suberect on thorax, the apical bands on first to fourth tergites narrower and not so dense as in *iridipenne;* tibial calcaria black. Wings strongly infumated with brown and with violaceous reflections, stigma and veins fuscous.

Head: Impunctate clypeal lobe a low triangle in outline; shortest distance between eyes at lower ends (across middle of clypeus) greater than shortest interocular distance on vertex (5.75:4); front granulate and with numerous small, shallow, subcontiguous punctures, the interspaces not so close as to form a network of fine carinae as in *korrorense*; frontal groove present but weak, running from anterior ocellus half the distance toward antennal insertions and terminating in a short carina; punctures of vertex slightly finer than on front, and separated by about the width of a puncture; postocellar distance about twice the ocellocular distance and three-fifths the diameter of a posterior ocellus; relative lengths of first three flagellar segments about 10:9:8; shortest interocular distance on vertex very slightly more than the first and second flagellar segments combined.

Thorax: Mesoscutum about as finely and sparsely punctate as vertex, the scutellum and postscutellum equally finely punctate, the latter more sparsely so; mesopleuron with punctures slightly larger than on mesoscutum, usually separated by about the width of a puncture; metapleuron minutely punctate, the upper third more densely so; lateral surface of propodeum separated from dorsal and posterior surfaces by a carina extending almost from the apex of the segment to a point on the dorsal surface halfway to the spiracle; dorsum of propodeum with median carina weak, present only on anterior half, the sulcus also weak but extending to apex, remainder of surface with sparse, delicate punctures separated by several times the width of a puncture (much sparser than in *iridipenne*) and without traces of oblique, discal carinae; lateral surface with slightly larger and much denser punctures; posterior surface with the usual median impression, the upper half with sparse, small punctures, the lower half with a few transverse rugae.

Abdomen: Tergites one to five slightly constricted at apices and with delicate punctures separated by several times the width of a puncture; sternites with the second somewhat more sparsely punctate than the second tergite, the succeeding sternites progressively more densely punctate than the second; third sternite with a small, low rounded tubercle on midline at about the basal third; hypopygium with a rounded impression near the apex, the apical margin broadly and very shallowly emarginate.

Wings: Forewing with petiole of second sumarginal cell subequal to height of cell; first and second recurrent veins interstitial with first and second transverse cubital veins.

Male paratypes vary in length from 5.6 to 6.8 mm. and the first recurrent vein of forewing is proximad of first transverse cubital vein in two specimens.

Allotype: ♀ ; Mt. Alutom, Guam; June 18, 1946 (H. K. Townes). [U. S. National Museum.]

*Female.* Length 8.1 mm., forewing 6.1 mm. Similar to type male except as follows: Clypeal lobe with apical margin broadly rounded; shortest distance between eyes at lower ends (across middle of clypeus) 2.3 times the

least interocular distance on vertex; postocellar distance about one-third the diameter of a posterior ocellus; relative lengths of first three flagellar segments about 6:5:5; the shortest interocular distance on vertex slightly more than the length of first flagellar segment; third abdominal sternite not tuberculate.

Paratype females show some variation in the details of venation, occasionally the first recurrent vein being received proximad of the first transverse cubital vein, or the second recurrent distad of the second transverse cubital. The two females from Rota Island have less strongly infumated wings, but are otherwise identical. Additional material from Rota may establish the presence of a distinct subspecies on that island. Paratype females vary in length from 7.0 to 8.1 mm.

Paratypes: 1 ♂ ; same data as type. 1 ♀, 1 ♂ ; Guam (D. T. Fullaway). 2 ♀ ; Ritidian Point, Guam; April 7, 1948 (K. L. Maehler; near damp mud bank). 1 ♀ ; North Field, Guam; March 7, 1948 (K. L. Maehler). 2 ♀ ; Haputo Point, Guam; March 10, 1948 (K. L. Maehler) [KLM]. 3 ♀ ; Haputo Point, Guam; March 14, 1948 (K. L. Maehler; in damp mud on trail). 1 ♀ ; same data, but March 27, 1948. 1 ♀ ; same data, but April 29, 1948 (K. L. Maehler; visiting Chinese ink berry). 1 ♀ ; Tarague, Guam; May 17, 1936 (O. H. Swezey). 1 ♀ ; Machanao, Guam; June 30, 1936 (R. L. Usinger). 1 ♀ ; Mt. Alutom, Guam; July 6, 1946 (H. K. Townes). 1 ♀, 1 ♂ ; Talofofo, Guam; June 16, 1946 (H. K. Townes; edge of native forest). 1 ♂ ; Talofofo, Guam; December 19, 1947 (K. L. Maehler; on taro leaves). 1 ♀ ; Sabana, Rota; June 19, 1946 (H. K. Townes; along roadside). 1 ♀ ; Rota; July 26, 1946 (R. G. Oakley). Two female and one male paratypes will be deposited in the B. P. Bishop Museum, Honolulu.

**Pison iridipenne** Smith

*Pison iridipennis* Smith, 1879. Jour. Linn. Soc. Zool. **14**: 676 [♀, ♂ ; Honolulu, Hawaii; type in London].

Typical *iridipenne* apparently occurs only in the Fijis, Samoa, Society Islands, Tuamotus, Hawaii, and the localities in Micronesia listed below. Williams, 1947 (Occ. Papers B. P. Bishop Mus. **18**: 331), states that it has been recorded also from Australia, but I can find no other published record to this effect. Specimens from the Philippines are not typical *iridipenne*. It is a member of an exceedingly difficult assemblage of closely related species or subspecies of which females seem almost identical. The males of this group differ especially in the character of the third abdominal sternite, some having it unarmed, others having a median tubercle, a pair of tubercles, or a short transverse ridge. I suspect that adequate populations may show that many of the forms now considered as species, such as *korrorense* Yasumatsu, may have to be reduced to subspecific rank.

This species has been recorded as nesting in holes in timber, or partitioning clay cells of *Sceliphron*. The cells are provisioned with small spiders.

MARSHALL ISLANDS: 8♀ ♀ ; Airek Island, Ailinglapalap Atoll; August 26, 1946 (H. K. Townes).

MARIANA ISLANDS: 1♂ ; Hagoya Lake, Tinian; June 10, 1946 (H. K. Townes). 1♀ ; Tinian; June 8, 1946 (H. K. Townes). 1♀ ; Marpo Valley, Tinian; June 8, 1946 (R. G. Oakley). 1♀ ; Mt. Lasso, Tinian; June 12, 1946 (H. K. Townes; on leaves of *Melanolepis multiglandulosa*).

CAROLINE ISLANDS: 1♀ ; Mt. Tafeyät, Kusaie Island; July 21, 1946 (H. K. Townes; primary forest, 800-1200 ft. alt.). 1♀ ; Tamon, Ponape Island; February 27, 1936 (Z. Ono) [BPB]. 1♀ ; Dublon Island, Truk Atoll; February 10, 1948 (K. L. Maehler). 1♀ ; Peleliu Island, Palaus; July 23, 1946 (H. K. Townes).

**Pison korrorense** Yasumatsu

*Pison korrorensis* Yasumatsu, 1937. Mushi **9**: 133, pl. 10, fig. 5 [♀, ♂ ; Koror Island, Palaus; type in Fukuoka, Japan].— Yasumatsu, 1939. Festschr. 60 Geburtst. E. Strand **5**: 83.

As stated under the discussion of *iridipenne*, the present species may eventually have to be treated as a subspecies of the former when adequate material is at hand. I have seen only one female of this complex from the Palaus (Peleliu Island), and it appears to be identical with typical *iridipenne*. Yasumatsu's description of the female of *korrorense* offers no points of distinction between it and *iridipenne*. The male is quite distinct from *iridipenne* in the bituberculate third abdominal sternite and punctation of front. I am unable to say whether the latter character is the same in the female. My male of *korrorense* also has the dorsum of the propodeum entirely without oblique discal carinae, but since their development is subject to some variation in *iridipenne*, though seemingly always present to some extent, I have not attempted to use it as a key character. Judging from Yasumatsu's description of the female, the dorsum of the propodeum is the same as in my male.

CAROLINE ISLANDS: 1♂ ; Koror Island, Palaus; March 15-25, 1948 (K. L. Maehler).

## BIBLIOGRAPHY OF PAPERS ON MICRONESIAN WASPS


Bequaert, J., and K. Yasumatsu, 1939. Vespoidea of Micronesia. Tenthredo **2**: 314–328, 4 pls.

Betrem, J. G., 1928. Monographie der indo-australischen Scoliiden mit zoogeographischen Betrachtungen. Treubia, Suppl. Vol. **9**: 92.

Esaki, T., 1938. The occurrence of a Mutillid wasp in Micronesia. Annot. Zool. Jap. **17**: 431–432, 1 fig.

Fullaway, D. T., 1913. Report on a Collection of Hymenoptera made in Guam, Marianne Islands. Proc. Hawaii. Ent. Soc. **2**: 283.

Holmgren, A. E., 1868. Hymenoptera. K. Svensk. Fregatt. Eugenies Resa, Ins., p. 439.

Swezey, O. H., 1942. Wasps of Guam. *In* Insects of Guam. I. B. P. Bishop Mus. Bul. **172**: 184–187.

Townes, H. K., 1946. Results of an entomological inspection tour of Micronesia. Rpt. **14**, U. S. Comm. Co. Econ. Surv. Micronesia, pp. 48–51.

Turner, R. E., 1911. Notes on Fossorial Hymenoptera. III. On Some Species of Thynnidae, Scoliidae and Sapygidae. Ann. Mag. Nat. Hist. (8) **7**: 308–309.

Uchida, T., 1933. Revision der japanischen Scoliiden mit Beschreibung der neuen Arten und Formen. Jour. Faculty Agr. Hokkaido Imp. Univ. **32**: 257, pl. 2, figs. 14, 15.

van der Vecht, J., 1941. The Indo-australian species of the genus Ropalidia (=Icaria). I. Treubia **18**: 122.

Williams, F. X., 1945. The Aculeate Wasps of New Caledonia, with Natural History Notes. Proc. Hawaii. Ent. Soc. **12**: 425.

Yasumatsu, K., 1937. Sphecoidea of Micronesia. Mushi **9**: 129–134, 1 fig., 1 pl.

——— 1939. Sphecoidea of Micronesia. II. Crabronidae. Mushi **12**: 153–155, 1 pl.

——— 1939. Notes supplementaires sur le genre Pison Spinola du Japon. Festschr. 60 Geburtst. E. Strand **5**: 82–84.

——— 1940. Collecting trip to Pagan Island (Marianas). Akitu **2**: 184–185.

——— 1941. Sphecoidea of Micronesia. III. Family Larridae. Mushi **14**: 44–47, 1 pl.

——— 1945. Vespoidea of Micronesia. 2. Mushi **16**: 35–45, 2 figs.

# A Revised List of Host Plants of the Melon Fly in Hawaii[1]

By O. C. McBRIDE and Y. TANADA

U. S. Department of Agriculture, Agri. Res. Adm., Bureau of Entomology and Plant Quarantine, and University of Hawaii Agricultural Experiment Station, Entomology Department

*(Prcsented at the meeting of Decçmber 8, 1947)*

A half-century ago the melon fly (*Dacus cucurbitae* Coq.) entered Hawaii and has since become the most important pest of cucurbits. However, it does not restrict its activity to the cucurbits alone, but infests plants in several other botanical families as well. A list of 10 host plants of melon fly in Hawaii was presented by Van Dine in 1906 and in 1908. In 1914 a list of 13 host plants was recorded by Severin *et al.* In 1917 and 1918, Back and Pemberton brought out more complete lists of 21 and 22 plants respectively. Since Back and Pemberton's work on the biology of the melon fly, no additional host list has been reported in Hawaii. The following list is presented to include several new hosts and also to revise the list presented by Back and Pemberton. The list of host plants in Hawaii is given in table 1. In table 2 is presented a list of plants which are not as yet recorded as hosts of the melon fly in Hawaii but which have been reported as such in other countries.

The extent of injury that may result from the attack of the melon fly depends upon the number of melon flies, the abundance and attractiveness of the hosts, the resistance of hosts to oviposition, and the development of larvae within the hosts. In table 1 the host plants are separated into five groups. The first three groups have been separated on the basis of the frequency of injury under general field conditions. The first group includes the highly susceptible plants, the fruits of which are frequently infested by the melon fly. The plants in the second group are infested only occasionally, and in general not all their fruits are injured. The plants in the third group are rarely infested and the fourth group includes the host plants that are not being cultivated. It is apparent that the position of some of these plants may vary depending on the availability of favorable hosts and on the population of the melon fly. For example, beans and peppers are heavily infested when the melon fly population is high and when more susceptible hosts are lacking.

Most of the plants in the first four groups have been confirmed by us, and our colleagues in the University and Bureau of Entomology and Plant Quarantine's Fruit Fly Investigations Laboratory at Honolulu, as hosts of melon fly.[2] The remaining plants have been reported from reliable sources. Wherever there is a

[1] Published with the approval of the Director, University of Hawaii Agricultural Experiment Station as Technical Paper No. 165.

[2] For additional information regarding investigations on the melon fly see University of Hawaii Agricultural Experiment Station Biennial Reports 1942-1944 and 1944-46.

doubt as to the validity of a host record, the plant has been placed in the fifth group of "doubtful hosts."

For every host record the reference from which the record has been obtained is cited. Nearly all the scientific names given in the tables have been inserted by the present authors. These names have been obtained from the "Manual of Cultivated Plants" and "The Standard Cyclopedia of Horticulture" by L. H. Bailey (1941, 1944), and from Chung and Ripperton (1929).

In Hawaii plants representative of the following botanical families serve as hosts of the melon fly: (1) Cucurbitaceae, (2) Solanaceae, (3) Leguminosae, (4) Passifloraceae, (5) Malvaceae, (6) Anacardiaceae, (7) Lauraceae, (8) Caricaceae, (9) Rosaceae, (10) Rutaceae, (11) Moraceae, and (12) Cruciferae. However, the preferred hosts are the cucurbits and tomato. All the cultivated cucurbits are severely attacked, and only one, the chayote (*Sechium edule* Swartz.), is able to resist the attack successfully. There are very few records of the successful rearing of melon fly from chayote, although the female fly frequently punctures and usually lays eggs in the fruit. The eggs may hatch but the larvae fail to complete their development.

Many types of squashes and gourds are grown in Hawaii, and the literature on the melon fly hosts refers to them only by their common names. The squashes are mostly of the two species, *Cucurbita maxima* Duchesne and *C. moschata* Duchesne. Among the gourds there are the white-flowered gourd (*Lagenaria siceraria* [Molina] Standl.), the dish-cloth gourds (*Luffa acutangula* [L.] Roxb. and *L. cylindrica* Roem.), and the snake gourd (*Trichosanthes anguina* L.). There are undoubtedly other species that have been grown in Hawaii and found susceptible to melon fly infestation.

The beans, especially string bean and cowpea, are apt to be attacked when there is an abundance of melon flies in the vicinity. The lima bean was never found infested by Back and Pemberton (1917), but in 1946 several bean pods that had been collected (by Y. T.) from the King's Daughters Home at Waialae, Honolulu, were found infested with melon fly. The infested pods were firm and slightly purplish at the site of oviposition punctures. From 12 pods about 50 adults were reared. Lucas (1941) has reported rearing the melon fly from hyacinth bean (*Dolichos Lablab* L.).

Okra has been found (by O.C.M.) to be a host of the melon fly. In 1945, 16 melon flies emerged from 1 okra pod picked from the garden of the Pineapple Research Institute at the University of Hawaii. Melon flies also oviposited in stems of okra plants that were about 3 feet tall and growing on the University Farm.

In 1930 Fleury reported that the puparia of the melon fly were found by the California Plant Quarantine Service in cucumber and dry onions from Hawaii. We question whether onion is a host of the melon fly.

Pepper, kohlrabi, and cabbage were reported by Back and Pemberton (1917, 1918) as erroneously recorded host plants. They have been reported from Hawaii previously as follows: pepper and cabbage were reported as hosts by Fullaway in 1914; however, in 1915 he thought it was an abnormal condition in the cabbage plant that resulted in attack by melon fly and considered such attack as of a secondary nature; Severin *et al.* (1914) included kohlrabi in their list of host plants. One of the present authors (Y.T.) has reared the melon fly from both pepper and kohlrabi.

The melon fly was reared in 1946 from six varieties of bell pepper (Calwonder Early, Waialua, Large Early Neapolitan, Okamura M, Fordhook, and Manatu Wonder) which were growing on the farm of the University of Hawaii Agricultural Experiment Station. The infestation was rather severe, and many infested fruits dropped prematurely. The symptoms of the infested fruits were like those on tomato—an initial discolored, water-soaked streak and later collapse of the fruit into a soft, soggy mass.

The infested kohlrabi was collected in March 1945 from a garden of the Central Union Church on Beretania St., Honolulu. The stems when collected were firm and had several deep cracks extending from the bases of the leaves part way down the sides of the enlarged portion. The condition was unlike the soft rot which is usually found in tomato and cucurbits. From 3 fully enlarged stems of kohlrabi, 31 melon flies and 6 scavenger flies, *Atherigona excisa* (Thomson), emerged.

In the fall of 1945 a cauliflower plant which was infested with melon fly was found (by O.C.M.). It was wilted and had several punctures on the stem just below the head. At the site of the punctures soft rot had begun to develop. When the stem was cut open, several larvae were found and from them two adults were reared. In 1946 a grower reported that the melon fly was infesting his cauliflower, but the report was not confirmed.

Two growers, who were farming at Koko Head, Oahu, reported that broccoli was being infested by the melon fly. In the field of one of the farmers we saw several plants which, according to the farmer, had been infested by maggots of the melon fly. The infestation was old and no maggot was present at the time. Both farmers were university graduates, and since they were familiar with the melon fly, their report of broccoli as a host of melon fly is probably authentic. Another grower who was farming at Waialua, Oahu, also reported that the melon fly was infesting his broccoli.

Hardy (1949) reared the melon fly from samples of kai choy, a leaf-mustard cabbage (*Brassica juncea* [L.] Cosson), obtained from Hilo, Hawaii. He reported that the assistant county agent found the infestation in kai choy rather general in the Hilo area, and that there was severe damage in some fields.

The fruit crops, in contrast to the vegetable crops, are rarely attacked by the melon fly. Such fruits as waterlemon (passion

fruit), orange, fig, papaya, peach, and mango have been reported as hosts by various sources (Van Dine 1906, 1908; Ehrhorn 1910; Severin *et al.* 1914; Back and Pemberton 1918; Strong 1937; Nishida 1949). The melon fly has been reared from avocado and mango (by O.C.M.). In 1946, from 19 avocado fruits that had ripened on the tree, 5 melon flies emerged. The mango varieties, Common or Manini, French, Fairchild, and Pirie, have been found infested. From 31 fruits of the Common variety 10 flies emerged; from 20 fruits of the French variety 2 flies; from 20 fruits of the Fairchild variety 10 flies; and from 22 fruits of the Pirie variety 1 fly.

Under laboratory conditions the melon fly has been bred frequently in ripe papaya (O.C.M.). In the field C. B. Keck[3] observed a melon fly ovipositing in a small ripe papaya at Kailua, Oahu, on August 28, 1946. The fruit was placed in a cage over sand, and 55 melon flies were reared.

There are three additional fruit crops, tangerine (*Citrus reticulata* Blanco), longan (*Euphoria Longan* [Lour.] Steud.), and Bluefield banana (*Musa paradisiaca* L. ssp. *sapientum* [L.] Ktze.), from which Miss Mabel Chong[3] of the Territorial Board of Agriculture and Forestry has reared the melon fly. Since she obtained only 1 or 2 melon flies from each type of fruit, these hosts have been placed in the category of doubtful hosts until they are confirmed by further records. From 10 fruits of tangerine, which were collected in Honolulu (Punahou) on April 22, 1947, there were 259 oriental fruit flies (*Dacus dorsalis* Hendel) and 1 melon fly; from 94 fruits of longan collected in Honolulu (Nuuanu) on July 14, 1947, were 10 oriental fruit flies and 2 melon flies; from 11 fruits of Bluefield banana collected in Kaneohe, Oahu, on August 25, 1947, were 1 oriental fruit fly and 1 melon fly.

Within susceptible host plants there are certain varieties that are resistant to the melon fly. Fernando and Udurawana (1941) found some strains of bittergourd, *Momordica Charantia* L., to be more resistant than others. They found that four Central Division strains were more resistant than a North-Western Division strain. The Central Division strains were not significantly different from one another. The strain green rough, however, was consistently the best in regard to resistance to the melon fly and also in crop yield. Krauss (1905) reported that, among four varieties of squash, Hubbard was more resistant than Summer Crook Neck, Scallop, and Gold o'Heart.

Some varieties of tomato show marked resistance to melon fly. In 1904 Smith noted that some varieties of tomato in Hawaii were resistant, but he did not identify these varieties. In 1919 Higgins reported that a small-fruited wild variety growing in Hawaii appeared to be immune, and that the "pear" and "plum" varieties were also resistant. He believed that resistance in tomato

[3] Unpublished note.

was due to a combination of slipperiness and toughness of the skin and to certain characters concerning the shape of the fruit. The offspring of crosses between resistant varieties and susceptible commercial varieties was less susceptible (Higgins 1919; Pope 1924, 1925). Sumida *et al.* (1943) reported that a wild cherry tomato, the Hawaiian Cherry, was apparently resistant. This variety is apparently the one referred to by Higgins in 1919. Back and Pemberton (1917, 1918) reported that they had never found the melon fly attacking the fruits of currant tomato (*Solanum pimpinellifolium* [also known by present-day botanists as *Lycopersicon esculentum* Mill. subsp. *Galeni* (Mill.) Luckwill (*L. esculentum* var. *cerasiforme*)], grape tomato (*S. lycopersicon* [also known as *Lycopersicon esculentum* Mill.]), popolo (*Solanum nodiflarum* Jacq.), and a spiny yellow-fruited *Solanum*.

While working with two varieties of tomato, Marlowe (1937) found that the average infestation by the melon fly was 19.3 per cent for the Break O'Day variety, and 59.3 per cent for the Pritchard variety. The average yield of marketable fruits of Break O'Day was eight times that of Pritchard.

In 1917 Back and Pemberton reported that most varieties of bean were seldom attacked by the melon fly and only the fleshy, long-podded Chinese variety was susceptible to infestation. They also noted distinct differences in susceptibility among varieties of cowpea. In 1919 Higgins reported that J. H. Cowan tested the susceptibility of 16 varieties of bean to the melon fly. Cowan found that the varieties Early Refugee and Refugee Wax were not infested by the fly, the varieties Stringless Refugee (not wax) and the Ventura Wonder Wax had less than 1 per cent injury, and the varieties Stringless Green Pod and Black Valentine, which were most heavily attacked, had infestations of 21.1 and 16 per cent, respectively. Holdaway (1940) also noticed a difference in susceptibility among three varieties of string bean. The variety Lualualei exhibited the highest percentage of attack, McCaslan the next, and Kentucky Wonder the lowest. He stated that a bush green-podded type of bean, Tendergreen, was observed by the grower to be the most heavily attacked of all.

**Table 1.—Host plants of the melon fly recorded in Hawaii**

| HOST PLANT | REFERENCE |
|---|---|
| **Plants Frequently Injured** | |
| Cucurbitaceae: | |
| Cantaloupe or muskmelon (*Cucumis Melo* L.)[4] | Van Dine 1906, 1908; Severin *et al.* 1914; Back and Pemberton 1917, 1918. |
| Gourds (*Lagenaria siceraria* [Molina] Standl. [Syn. *L. leucantha* and *L. vulgaris*]; *Luffa cylindrica* Roem.; *Luffa acutangula* ]L.[ Roxb.; *Trichosanthes anguina* L.) | Back and Pemberton 1917, 1918. |
| Chinese cucumber, *Momordica* sp. (Balsam-pear, *Momordica Charantia* L.) | |
| Chinese melon (Chinese preserving melon, *Benincasa hispida* [Thunb.] Cogn. [Syn. *B. cerifera*]; oriental pickling melon, *Cucumis Melo* var. *Conomon* [Thunb.] Makino) | |
| Squash (*Cucurbita maxima* Duchesne; *C. moschata* Duchesne) | Van Dine 1906, 1908; Severin *et al.* 1914; Back and Pemberton 1917, 1918. |
| Cucumber (*Cucumis sativus* L.) | |
| Pumpkin (*Cucurbita Pepo* L.) | |
| Watermelon (*Citrullus vulgaris* Schrad.) | |
| Solanaceae: | |
| Tomato (*Lycopersicon esculentum* Mill.) | |
| **Plants Occasionally Injured** | |
| Leguminosae: | |
| String bean (*Phaseolus vulgaris* L.)[5] | Van Dine 1906, 1908; Severin *et al.* 1914; Back and Pemberton 1917, 1918. |
| Cowpea (*Vigna sinensis* [L.] Savi) | Back and Pemberton 1917, 1918. |
| Hyacinth bean, *Dolichos Lablab* L. | Lucas 1941. |
| Lima bean, *Phaseolus limensis* Macf. | Tanada.[6] |
| Solanaceae: | |
| Green pepper (*Capsicum frutescens* L. var. *grossum* [L.] Bailey)[6] | Fullaway 1914; Maskew 1919; Tanada.[6] |
| Eggplant (*Solanum Melongena* L.) | Fullaway 1914; Severin *et al.* 1914; Back and Pemberton 1917, 1918. |

[4] Names in parentheses have been inserted by the authors.
[5] Occasionally heavy infestation occurs in favorable localities.

**Table 1.—Continued**

| HOST PLANT | REFERENCE |
|---|---|
| **Plants Rarely Injured** | |
| Anacardiaceae: | |
| Mango (*Mangifera indica* L.) | Van Dine 1906, 1908; Severin *et al.* 1914; Back and Pemberton 1917, 1918. |
| Caricaceae: | |
| Papaya (*Carica Papaya* L.) | Van Dine 1906, 1908; Severin *et al.* 1914; Back and Pemberton 1917, 1918; Strong 1937. |
| Cruciferae: | |
| Kohlrabi (*Brassica caulorapa* [DC.] Pasq.) | Severin *et al.* 1914; Tanada.[6] |
| Cauliflower, *Brassica oleracea* var. *botrytis* L. | McBride.[6] |
| Leaf-mustard cabbage, *Brassica juncea* (L.) Cosson | Hardy 1949. |
| Cucurbitaceae: | |
| Chayote (*Sechium edule* Swartz) | Back and Pemberton 1918. |
| Lauraceae: | |
| Avocado, *Persea americana* Mill. [Syn. *P. gratissima*] | McBride.[6] |
| Leguminosae: | |
| Pigeon pea (*Cajanus Cajan* [L.] Millsp.) | Foreign Plant Quarantine Interception Files 12014, 1946.[6] |
| Malvaceae: | |
| Okra, *Hibiscus esculentus* L. | McBride.[6] |
| Moraceae: | |
| Fig (*Ficus Carica* L.) | Back and Pemberton 1917, 1918. |
| Passifloraceae: | |
| Waterlemon, *Passiflora* sp. | Back and Pemberton 1917, 1918. |
| *Passiflora Seemanni* Griseb. | Nishida 1949 |
| Rosaceae: | |
| Peach (*Prunus Persica* [L.] Batsch) | Back and Pemberton 1917, 1918. |
| Rutaceae: | |
| Orange (*Citrus sinensis* [L.] Osbeck) | Ehrhorn 1910; Severin *et al.* 1914; Back and Pemberton 1917, 1918. |
| **Wild Hosts** | |
| Cucurbitaceae: | |
| *Momordica* sp. (Balsam-apple, *Momordica Balsamina* L.) | Back and Pemberton 1917, 1918. |
| *Sycos* sp. (*Sicyos* ?) | Van Dine 1906, 1908; Severin *et al.* 1914; Back and Pemberton 1917, 1918. |

[6] Unpublished.

**Table 1.—Continued**

| HOST PLANT | REFERENCE |
|---|---|
| **Doubtful Hosts** | |
| Cruciferae: | |
| Broccoli, *Brassica oleracea* L. var. *botrytis* L. | Report of three farmers. |
| Cabbage (*Brassica oleracea* L. var. *capitata* L.) | Fullaway 1914, 1915. |
| Liliaceae: | |
| Dry onion (*Allium Cepa* L.) | Fleury 1930. |
| Musaceae: | |
| Bluefield banana, *Musa paradisiaca* L. ssp. *sapientum* (L.) Ktze. | Chong.[6] |
| Rutaceae: | |
| Tangerine, *Citrus reticulata* Blanco | |
| Sapindaceae: | |
| Longan, *Euphoria Longan* (Lour.) Steud. | |

**Table 2.—Plants which have not been recorded in Hawaii as hosts of the melon fly, but which have been reported as such in other localities**

| HOST PLANT | COUNTRY | REFERENCE |
|---|---|---|
| Cucurbitaceae: | | |
| *Bryonopsis laciniosa* (L.) Naud. | Formosa | Shiraki 1933. |
| *Citrullus* sp. | Java | Back and Pemberton 1917, 1918. |
| *Cucumis* sp. | India; Burma | Fletcher 1917. |
| Dondakaya or kovaikkai, *Coccinia indica* Wight and Arn. (*C. cordifolia* [L.] Cogn.)[7] | India | Cherian and Sundaram 1939. |
| *Luffa* spp. | Philippines; India | Woodworth 1922 (II); Pruthi 1937. |
| *Melothria heterophylla* Cogn. | Formosa | Shiraki 1933. |
| *Parya-soorten, Momordica* sp. | Java | Franssen 1937. |
| *Trichosanthes cucumerina* L. | India; Burma | Fletcher 1917. |
| *Trichosanthes cucumeroides* Maxim. | Formosa | Shiraki 1933. |
| *Trichosanthes dioica* Roxb. | India; Burma | Fletcher 1917. |
| Leguminosae: | | |
| *Mungos or green gram, *Phaseolus radiatus* L. | Philippines | Woodworth 1921 (I). |
| *Vigna* spp.: cowpea, sitao, **Vigna sesquipedalis* (Koern.) Wight, etc. | | |
| Annonaceae: | | |
| *Annonas or custard-apple (*Annona reticulata* L.) | Philippines | Woodworth 1922 (III); Ponce 1937. |
| *Ates or sugar-apple (*Annona squamosa* L.) | | |
| *Guanabanos or soursop (*Annona muricata* L.) | | |
| Myrtaceae: | | |
| *Guava, *Psidium Guajava* L. | Philippines; India | Woodworth 1922 (III); Chopra 1928; Ponce 1937. |
| Palmae: | | |
| *Date (*Phoenix dactylifera* L.) | India | Chopra 1928. |
| Passifloraceae: | | |
| *Granadilla, *Passiflora quadrangularis* L. | Philippines | Woodworth 1921 (I). |
| *Passion flower, *Passiflora edulis* Sims. | | |
| *Passion flower, *Passiflora foetida* L. | | |
| Rosaceae: | | |
| *Apple (*Pyrus Malus* L.) | Japan[8] | Fukai 1938. |
| *Pear (*Pyrus communis* L.) | | |
| *Strawberry (*Fragaria chiloensis* [L.] Duchesne) | | |
| Rutaceae: | | |
| Citrus (*Citrus* spp.) | India; Japan[8] | Husain 1929; Fukai 1938. |

* Plants found in Hawaii also.
[7] Names in parentheses have been inserted by the authors.
[8] Probably not field infestation.

## Summary

A list of host plants of the melon fly (*Dacus cucurbitae* Coq.) in Hawaii has been compiled. The list includes approximately 36 plants belonging to 12 botanical families. Four of these plants—lima bean (*Phaseolus limensis* Macf.), avocado (*Persea americana* Mill.), okra (*Hibiscus esculentus* L.), and cauliflower (*Brassica oleracea* L. var. *botrytis* L.)—are here reported for the first time as hosts of the melon fly. Pepper (*Capsicum frutescens* L. var. *grossum* [L.] Bailey) and kohlrabi (*Brassica caulorapa* [DC.] Pasq.), have been previously considered as erroneously recorded hosts, but because they have been found infested by the melon fly, they must be regarded as hosts. Six plants have been placed in the category of doubtful hosts until they are confirmed by further records.

The most susceptible hosts of the melon fly are the cucurbits and tomato. The host plants have been divided into five groups. The plants in the first three groups are separated on the basis of the frequency of injury under general field conditions. Wild and doubtful hosts make up the other two groups.

Host plants reported from other countries, but which have not yet been found infested in Hawaii, are also listed.

Certain varieties of bittergourd, squash, tomato, string bean, and cowpea have been reported to be much more resistant to infestation by the melon fly than other varieties of these species.



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## LITERATURE CITED


Back, E. A., and Pemberton, C. E. 1917. The melon fly in Hawaii. U. S. Dept. Agr. Bul. **491**, 64 pp.

——— and ——— 1918. The melon fly. U. S. Dept. Agr. Bul. **643**, 31 pp.

Bailey, L. H. 1941. Manual of cultivated plants. 851 pp., New York, N. Y.

——— 1944. The standard cyclopedia of horticulture. Ed. 3, Vols. I, II, III. New York, N. Y.

Cherian, M. C., and Sundaram, C. V. 1939. Notes on the life-history and habits of Dacus brevistylus Bezzi (Family Trypetidae), a pest of Coccinia indica fruits. India Jour. Agr. Sci. **9** (1): 127-131.

Chopra, R. L. 1928. Annual report of the entomologist to the government, Punjab, Lyallpur, for the year 1925-26. Punjab Dept. Agr. Rpt. 1925-26, **1** (II): 67-125.

Chung, H. L., and Ripperton, J. C. 1929. Utilization and composition of oriental vegetables in Hawaii. Hawaii Agr. Expt. Sta. Bul. **60**, 64 pp.

Ehrhorn, E. M. 1910. Division of Entomology. Report of superintendent of entomology. Hawaii. Forester and Agr. **7** (11): 336-338.

Fernando, M., and Udurawana, S. B. 1941. The relative resistance of some strains of bitter-gourd to the cucurbit fruit-fly. Trop. Agr. (Ceylon) **96** (6): 347-352.

Fletcher, T. B. 1917. Report of the proceedings of the second entomological meeting held at Pusa on 5th to 12th February 1917. (Calcutta, India.)

Fleury, A. C. 1930. Plant quarantine service. Calif. State Dept. Agr. Monthly Bul. 19 (12): 811-831.

Franssen, C. J. H. 1937. Biologie en bestrijding van een drietal schadelijke fruitvliegen. Landbouw 13 (5): 221-237.

Fukai, K. 1938. Studies on the possibility of life of the Formosan melon fly in Japan. [in Japanese.] Nojikairyo-Shiryo No. 134, pp. 147-213, 8 pls. [Tokyo.] (Rev. App. Ent. [A] 26: 667-668.)

Fullaway, D. T. 1914. Report of the entomologist. Hawaii Agr. Expt. Sta. Ann. Rpt. 1913: 18-21.

——— 1915. Report of the entomologist. Hawaii Agr. Expt. Sta. Ann. Rpt. 1914: 43-50.

Hardy, D. E. 1949. Note, Hawaii. Ent. Soc. Proc. 13(3): 339.

Higgins, J. E. 1919. Report of the Horticultural Division. Hawaii Agr. Expt. Sta. Ann. Rpt. 1918: 13-21.

Holdaway, F. G. 1940. Differential susceptibility of varieties of garden bean to oviposition by melon fly, Dacus cucurbitae Coq. Hawaii. Ent. Soc. Proc. 10 (3): 421-422.

Husain, M. A. 1929. Annual report of the entomologist to the government, Punjab, Lyallpur, for the year 1927-28. Punjab Dept. Agr. Rpt. 1927-28. 1 (II): 55-79.

Krauss, F. G. 1905. The vegetable garden. Hawaii. Forester and Agr. 2 (11): 353-361.

Lucas, E. 1941. Notes and exhibitions. Hawaii. Ent. Soc. Proc. 11 (1): 9.

Marlowe, R. H. 1937. Susceptibility of two tomato varieties to infestation by Chaetodacus cucurbitae (Coq.). Hawaii. Ent. Soc. Proc. 9 (3): 407-408.

Maskew, F. 1919. Report for the month of August, 1919. Calif. State Comm. Hort. Monthly Bul. 8 (9): 544-545.

Nishida, T. 1949. Note, Hawaii. Ent. Soc. Proc. 13(3): 338.

Ponce, A. 1937. The melon fly (Dacus cucurbitae Coquillet). Philippine Jour. Agr. 8 (3): 289-309.

Pope, W. T. 1924. Report of the Horticultural Division. Hawaii Agr. Expt. Sta. Ann. Rpt. 1922: 2-8.

——— 1925. Report of the Horticultural Division. Hawaii Agr. Expt. Sta. Ann. Rpt. 1924: 4-10.

Pruthi, H. S. 1937. Report of the imperial entomologist. Agr. Res. Inst. New Delhi Sci. Rpt. 1935-36: 123-137. (Rev. App. Ent. [A] 25: 529-530.)

Severin, H. H. P., Severin, H. C., and Hartung, W. J. 1914. The ravages, life history, weights of stages, natural enemies and methods of control of the melon fly (Dacus cucurbitae Coq.). Ent. Soc. Amer. Ann. 7 (3): 177-212.

Shiraki, T. 1933. A systematic study of Trypetidae in the Japanese Empire. Memoirs of the Faculty of Sci. and Agr., Taihoku Imp. Univ., 8, 509 pp. (Formosa.)

Smith, J. G. 1904. Annual report of the Hawaii Agricultural Experiment Station for 1903. U. S. Off. Expt. Sta. Ann. Rpt. 1903: 391-418.

Strong, L. A. 1937. Report of the chief of the Bureau of Entomology and Plant Quarantine, 1937. U. S. Dept. Agr. Bur. Ent. Pl. Quar., 98 pp.

Sumida, D., Kikuta, K., and Frazier, W. A. 1943. Tomatoes. Hawaii Agr. Expt. Sta. Rpt. 1941, 1942: 107-108.

Van Dine, D. L. 1906. The melon-fly (Dacus cucurbitae Coquillett.). Hawaii. Forester and Agr. 3 (4): 127-129.

——— 1908. Report of the entomologist. Hawaii Agr. Expt. Sta. Ann. Rpt. 1907: 25-51.

Woodworth, H. E. 1921-22. A host index of insects injurious to Philippine crops. Philippine Agr. (I) 10 (1): 9-35; (II) 10 (7): 321-329; (III) 11 (2): 49-55.

# The Muscid Genus Ophyra in the Pacific Region (Diptera)

By CURTIS W. SABROSKY
Bureau of Entomology and Plant Quarantine
Agricultural Research Administration, U. S. Department of Agriculture
*(Presented by Mr. Tanada at the meeting of April 12, 1948)*

The scavenger flies of the genus *Ophyra* R. D. are common, and the species are widely distributed, probably because they breed in decaying vegetation, carrion, or manure. Because of the close resemblance of the species, misidentifications can easily occur, especially when only female specimens are available. It has therefore seemed desirable to review the species of the Pacific region, and to make available a key for their determination. The synopsis by Malloch (1923, Annals & Mag. Nat. Hist., [9], 11: 664-666) is a sound basis for the study of the genus, and the following key is essentially a modification and enlargement of his work. As accepted here, the genus is a combination of *Ophyra* and *Peronia* as defined by Séguy (1937, Genera Insectorum).

Bryan (1934, Proc. Hawaii. Ent. Soc. 8: 425, 453) stated that *Ophyra nigra* and *O. chalcogaster* were of general distribution in the Hawaiian Islands, and that *O. aenescens* and *O. leucostoma* probably did not occur there, even though they had been recorded in older literature. I have not seen *nigra* from Hawaii, but *aenescens* has been received for determination several times. Yoshinori Tanada informs me that *aenescens* is the species that has thus far been known in Hawaii as *nigra*. Most of the misidentifications in the genus appear to center about the latter, for I have seen five different species identified under that name.

Although only two species, *chalcogaster* and *aenescens*, are definitely known to me to occur in Hawaii, several others may at any time be found there. The following key has therefore been framed to include all species known to occur anywhere in the Pacific area, together with *O. capensis* which is introduced for comparison with a new species. Two species described by Stein, *hirtitibia* from Java and *simplex* from Formosa, are included in the key to males only on the basis of Stein's descriptions.

The figures have been selected to show sufficient variety in the important characters, so that one can compare other species and better realize the modifications in the several species.

## KEY TO THE SPECIES OF OPHYRA OF THE PACIFIC REGION

### Males

1. Habitus like a small *Calliphora*, the thorax dull black and abdomen dark metallic blue with whitish pollen, especially on apical segment; frontal lunule not silvery pollinose (*Australophyra*) ..... **O. rostrata** (R. D.) **O. analis** Macq.

   Not so; the thorax and abdomen concolorous, dull black to shining black, abdomen at most with an obscure, fine pollen or bloom..... 2.

2. Palpus yellow or reddish yellow; hind tibia posteroventrally without either bristles or long setaceous hairs, and anteroventrally with only two or three short bristles (fig. 7); both mid and hind femora with some short, stout, erect spines on the ventral surface near the base.....**O. aenescens** (Wd.) (p. 427)
Palpus black; hind tibia posteroventrally with some to many long setaceous hairs, except in *simplex*..... 3.

3. Hind tibia strongly arched beyond the basal third, and densely clothed with long hairs both antero- and posteroventrally; both mid and hind femora with short spines ventrally near the base, hind femur usually with only one spine, mid femur with two irregular rows (fig. 4).....**O. leucostoma** (Wd.) (p. 428)
Hind tibia straight or only gently curved..... 4.

4. Middle femur ventrally near the base with 2-3 short, erect, stout, black spines or spinelike bristles (fig. 5); posterior margin of eye, as viewed in profile, distinctly emarginate (fig. 2)..... 5.
Middle femur without such spines, at most with only fine, slender, erect hairs ventrally near the base (fig. 6); posterior margin of eye not emarginate in *chalcogaster* (fig. 3), but unknown to me for *hirtitibia* and *simplex*..... 7.

5. Mesonotum anterior to suture densely and uniformly covered with long, erect, fine hairs, the dorsocentral and acrostichal bristles weak and scarcely differentiated from hairs; hind femur ventrally near base with an erect but weak, slender, and inconspicuous hair..... 6.
Mesonotum not densely and uniformly haired, with bare stripes between the median group of hairs and each row of dorsocentral bristles; hairs short, dorsocentral bristles strong and conspicuous; hind femur ventrally near base with one, sometimes two, short stout spinelike bristles.....**O. nigra** (Wd.) (p. 428)

6. Parafrontal and upper part of parafacial glabrous and polished black.....**O. capensis** (Wd.) (p. .....)
Parafrontal and upper part of parafacial gray to brownish pollinose.....**O. obscurifrons** Sabr. (p. 430)

7. Hind femur ventrally near base with one row, and a partial second, of short stout spines; segments of fore tarsus with yellow to whitish apices, the pale area most extensive ventrally.....**O. chalcogaster** (Wd.) (p. 431)
Hind femur without spines ventrally near base; fore tarsus black.. 8.

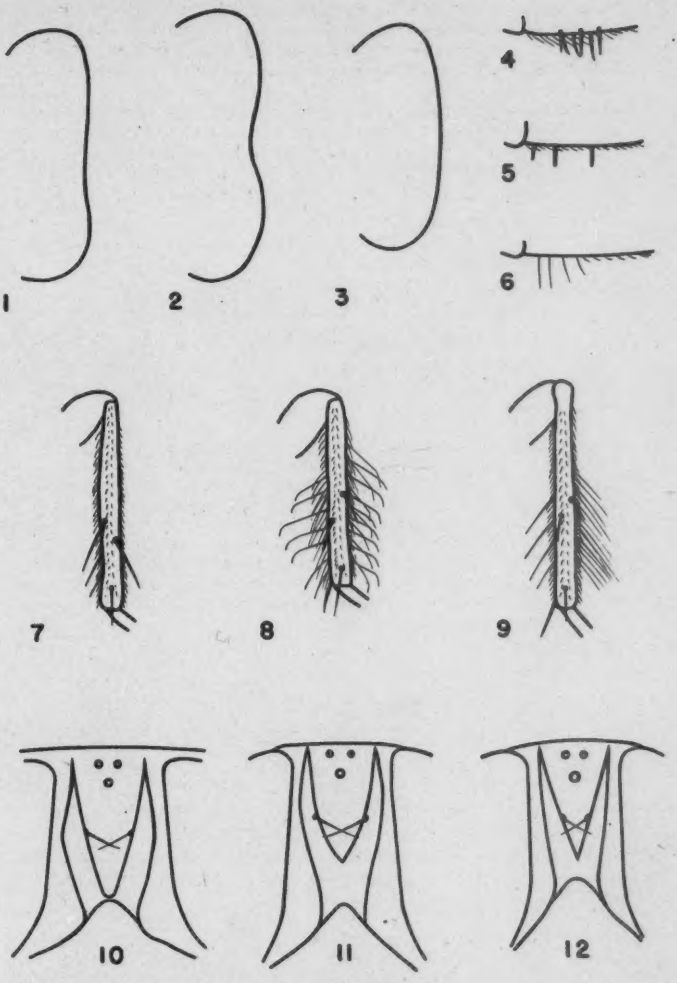
8. Hind tibia both antero- and posteroventrally with long setaceous hairs; antenna of normal length, not elongate as in *simplex*.....**O. hirtitibia** Stein
Hind tibia without long setaceous hairs, with only a few short bristles; antenna elongate, the apex almost opposite the lower margin of an eye.....**O. simplex** Stein

**Females**

(Unknown, or the characters not known, for *hirtitibia* and *simplex*)

1. Species with blue abdomen and black thorax (see key to males).....**O. rostrata** (R.D.) and **O. analis** Macq.
Thorax and abdomen concolorous..... 2.

2. Palpus yellow; frontal triangle elongate, extending the full length of the front up to the lunule, apically subtruncate or broadly rounded (fig. 10).....**O. aenescens** (Wd.) (p. 427)
Palpus black; frontal triangle short, ending well before the lunule, or if longer, the apex is acute (figs. 11, 12)..... 3.




Characters of *Ophyra* species

Figs. 1-3, posterior margin of eye, in side view; figs. 4-6, profile of the ventral surface of middle femur of male, toward the base; figs. 7-9, outer aspect of left hind tibia of male, the anterior bristles (anterodorsal and anteroventral) projecting toward the left, the posterior toward the right; figs. 10-12, proportions of the front and frontal triangle of the female.

Figs. 1, 7, and 10, **Ophyra aenescens**; figs. 2, 5, and 11, **O. nigra**; figs. 3, 6, 9, and 12, **O. chalcogaster**; fig. 4, **O. leucostoma**; fig. 8, **O. obscurifrons.**

3. Mesonotum anterior to the suture densely and uniformly covered with long, erect, fine hairs, the dorsocentral and acrostichal bristles weak and scarcely differentiated from hairs; frontal triangle long and broad, the apex attaining the anterior margin of the front, or nearly so ..... 4.

Mesonotum not densely and uniformly covered with long hairs, the hairs short, relatively sparse, and usually with definite bare areas between the median group of hairs and each dorsocentral position, the dorsocentral bristles distinctly developed; frontal triangle short and broad, or if long, it is notably more slender than the above ..... 5.

4. Frontal triangle, parafrontal, and upper part of the parafacial glabrous and polished black ..... **O. capensis** (Wd.) (p. 429)

The above portions of the head gray to brownish pollinose ..... **O. obscurifrons** Sabr. (p. 430)

5. Frontal triangle broad, its width at the level of the cruciate interfrontal bristles three times the width of the parafrontal directly opposite, the sides of the triangle convex (fig. 11); posterior margin of the eye as seen in profile conspicuously emarginate (fig. 2) ..... **O. nigra** (Wd.) (p. 428)

Frontal triangle slender, its width at the interfrontal level usually about twice the width of the parafrontal directly opposite, the sides of the triangle straight, or nearly so (fig. 12); posterior margin of the eye not emarginate (fig. 3), or at most only gently concave over its entire length ..... 6.

6. Arista entirely black; fore tarsus black; hind tibia with two or more anteroventral bristles ..... **O. leucostoma** (Wd.) (p. 428)

Arista yellow basally; fore tarsal segments with whitish-yellow apices; hind tibia typically with only one anteroventral bristle, occasionally with two or three ..... **O. chalcogaster** (Wd.) (p. 431)

## SPECIES OF THE PACIFIC REGION NOT INCLUDED IN THE KEY

*Ophyra spinigera* Stein (1910, Ann. Mus. Nat. Hung. **8**: 555), based on a single male from Singapore, may equal *O. nigra* as Malloch has suggested. Certainly the chaetotaxy of the legs sounds like *nigra,* but Stein's description of the thorax as almost entirely naked, and the acrostichal bristles entirely lacking, suggests the possibility that some other species was actually involved. Only a careful study of the holotype can settle this question.

*Ophyra gracilis* (Wiedemann) (Auss. Zweifl. Ins., **2**: 432), from China, has not been identified.

It may also be noted here that *Ophyra hirtitarsis* Stein (1907, Ann. Mus. Zool. Acad. Sci. St. Petersbourg **12**: 335), described from a single male from northeastern Tibet, runs to *nigra* on the basis of Stein's description, but insufficient critical details are given there to place it more definitely. Stein wrote that the orbits are silver gray pollinose, which would suggest *obscurifrons,* but his further statement that the acrostichals are strong and in two rows shows that *hirtitarsis* is something quite different.

## The Status of Australophyra Malloch

*Australophyra* Malloch, 1923, Annals & Mag. Nat. Hist., (9), **11**: 667. Type, *Ophyra analis* Macq.

*Peronia* Robineau-Desvoidy, 1830, Essai sur les Myodaires, p. 517. Type, *P. rostrata* R. D.

Hardy (1939, Proc. Roy. Soc. Queensland **50**: 38) placed *Peronia* R. D. (= *Australophyra* Mall.) as a synonym of *Ophyra,* on the ground that the distinctions on which the former were based are too weak and variable for generic separation. Certainly the species closely resemble *Ophyra,* though lacking the silvery lunule commonly associated with the genus, and the relation is evident when such a species as *O. obscurifrons* is considered. I agree with Hardy in the synonymy. If *Peronia* is segregated from *Ophyra,* however, as may be done by some authors, *Australophyra* should be used in preference to *Peronia,* for the latter is preoccupied by *Peronia* Fleming (1822) in the Mollusca. This fact was not noticed by Malloch when he sank his genus as a synonym of *Peronia* (1926, Proc. Linn. N. S. Wales **51**: 554), nor by Hardy.

*Ophyra rostrata* (R. D.) and *O. analis* Macq., which are regarded by Hardy as separate species, are the only known species in the group.

**Ophyra aenescens** (Wd.)

*Anthomyia aenescens* Wiedemann, 1830, Auss. Zweifl. Ins., **2**: 435. (Louisiana.)

*Ophyra trochanterata* Malloch, 1932, Bishop Mus. Bul. **98**: 196 (Marquesas, Tahiti). New synonym.

As the only known species of the genus with yellow palpi, it is easily distinguished by that feature in both sexes. The males are also distinctive in having a dense tuft of long hairs on the ventral surface of the hind trochanter, and in completely lacking any long setaceous hairs on the hind tibia (fig. 7). The posterior margin of the eye as seen in profile is only gently emarginate (fig. 1).

It has been considered that *aenescens* occurs only in the Americas and in southern Europe. It was recorded from the Hawaiian Islands by Grimshaw (1901, Fauna Hawaiiensis, **3**, pt. 1: 30), and again by Illingworth (1923, Proc. Hawaiian Ent. Soc. **5**: 277), but Bryan has stated that it "may not occur in Hawaii" (1934, Proc. Hawaiian Ent. Soc. **8**: 425). The material that I have studied recently, however, indicates that it is found in Hawaii and in a number of the islands of the eastern Pacific.

(1) The Galapagos' *Ophyra* with yellow palpi (*Anthomyia setia* Walker) is definitely *aenescens,* as already recognized by Aldrich and Curran.

(2) Malloch's detailed description of *trochanterata* fits typical

*aenescens* exactly. A long series of paratypes of the former was available for direct comparison.

(3) I have seen a number of specimens of *aenescens* from the Hawaiian Islands, including eight from Mt. Tantalus, Oahu, May 19 and June 3, 1939, the latter bred from rotten meat by Mr. Tanada.

(4) In the U. S. National Museum collection are two females of *aenescens,* collected on Nauru and Ocean Islands, just west of the Gilbert Islands, in June, 1908 (F. W. Steel), and previously determined by some author as *O. nigra.* This appears to be the westernmost record of *aenescens* up to the present time.

**Ophyra leucostoma** (Wd.)

*Anthomyia leucostoma* Wiedemann, 1817, Zool. Mag. **1**: 82.

This common North American and European species was recorded from Hawaii by Grimshaw (1901, op. cit., p. 30) and Howard (1901, Proc. Ent. Soc. Wash. **4**: 490), but the identifications were probably incorrect.[1] If correct, the species does not appear to have become established in the islands. The strongly bowed hind tibia of the male is unique in the genus, but the females are difficult to separate from other species. The appearance of the front and frontal triangle in the female sex is similar to that of *O. nigra* (cf. fig. 11), but the deeply emarginate eye of *nigra* fortunately is so distinctly different from *leucostoma* that these two should not be confused.

In the collection before me is a male from Japan, and another from Suifu, Szechuen, China (D. C. Graham), which are typical *leucostoma.*

**Ophyra nigra** (Wd.)

*Anthomyia nigra* Wiedemann, 1830, Auss. Zweifl. Ins. **2**: 432 (China).

*Ophyra nigra* (Wd.); Stein, 1910, Ann. Mus. Nat. Hung. **8**: 555, notes on type; Malloch, 1923, Annals & Mag. Nat. Hist., (9), **11**: 664-666.

It is possible that more than one species is really involved and that it should be referred to here as the "*nigra* complex." In males from China, the hind tibia has a row of 3-5 short, well-spaced bristles anteroventrally (as in fig. 9, but shorter), whereas South Pacific and Australian specimens generally have more and longer setaceous hairs on the anteroventral surface, sometimes approaching a densely bushy appearance. There are some intermediates, however, and the evidence is not conclusive. As recognized here, *Ophyra nigra* is a wide-ranging and common species represented

[1] Howard's record was based on four specimens collected in Hawaii by H. W. Henshaw. In the National Museum Collection, there are now ten specimens which were collected by Henshaw in Hawaii on various dates in 1900, and all of these are *Ophyra chalcogaster.*

in the collection by material ranging from China and Japan through many of the western Pacific Islands to Australia.

The deeply emarginate eye (fig. 2) is one of the most distinctive features, and one that will easily distinguish both sexes from *O. chalcogaster,* with which it has been frequently confused. Likewise, the short, broad frontal triangle of the female of *nigra* (fig. 11) will distinguish that sex from the other species of *Ophyra* in the Pacific, as far as known to me.

Specimens of *nigra* before me are from China (Ningyuenfu, Chihli, Szechuen), Japan, Vladivostok, Okinawa, Yap, Guam, Ponape, Bismarck Archipelago, the Solomons, the New Hebrides, Queensland (Brisbane, Cairns), and Northern Territory (Darwin).

Hardy (1939, l.c., p. 38) has identified a species from Queensland and New South Wales as *Ophyra fuscocalyptrata* (Macq.), and his species is undoubtedly what I have called *nigra* (see following discussion).

**Hydrotaea fusco-calyptrata** Macq.

*Hydrotaea fusco-calyptrata* Macquart, 1855, Dipt. Exot., suppl. **5**: 139 (Australia).

*Hydrotaea fuscocalyptrata* (Macq.); Stein, 1907, Ztschr. Hym. Dipt. **7**: 275. Notes on holotype.

*Ophyra fuscocalyptrata* (Macq.): Hardy, 1939, Proc. Roy. Soc. Queensland **50**: 38.

The status of this specific name is of interest in connection with the identity and distribution of *Ophyra nigra* (Wied.).

Hardy has referred Macquart's species to *Ophyra,* and has used the name to replace *"Ophyra nigra* of authors, at least in part," presumably for the Australian form. Macquart's original description, however, mentioned the spine on the fore femur, a characteristic of male *Hydrotaea.* The silvery lunule noted by Macquart, which has apparently influenced the reference to *Ophyra,* is indeed conspicuous in typical *Ophyra,* but it is also present in many *Hydrotaea.* Stein (1907) examined the type, and since that leading specialist in the muscid flies saw no reason to change the species from *Hydrotaea,* I believe that it should be left there.

**Ophyra capensis** (Wd.)

*Anthomyia capensis* Wiedemann, 1818, Zool. Mag. **1** (pt. 2): 46 (Cape Colony); 1830, Auss. Zweifl. Ins., **2**: 426.

*Anthomyia anthrax* Meigen, 1826, Syst. Beschr. **5**: 161 (Europe).

(? Synonym) *Ophyra villosa* Aldrich, 1928, Proc. U. S. Nat. Mus. **74** (Art. 1): 6 (Chile).

This species has commonly been called *anthrax,* apparently because *capensis* was considered to date from 1830. The priority of *capensis* Wiedemann (1818) has recently been recognized by several authors.

True *capensis* may not occur in the Oriental Region (cf. *obscurifrons,* new species), but for the purpose of comparison, the following description is given, based on a series of specimens from Germany:

Male: Shining bluish black or greenish black, with black palpi and white calypteres; posterior margin of the eye as viewed in profile distinctly emarginate; parafrontal and upper third to half of the parafacial glabrous and polished black, highly shining; mesonotum densely and uniformly covered with fine, erect hairs, the presutural dorsocentral and acrostichal bristles scarcely distinguishable, only slightly longer and stronger than the surrounding hairs; middle femur with one or more, typically two, short, straight, spinelike bristles on the mid-ventral surface near the base, but the hind femur with only fine hairs in the corresponding position; hind tibia with rather short and inconspicuous anterodorsal and posterodorsal bristles (one of each) about midway of the tibia, and ventrally with numerous conspicuously long, setaceous hairs, including one row of eight on the anteroventral surface and several rows on the posteroventral, all projecting nearly at right angles to the tibia and curling slightly at the ends (as in fig. 8, of *obscurifrons*).

Female: As described for the male, except as follows: front broad, the frontal triangle glabrous and polished like the parafrontal, long and ending acutely close to the lunule, the width of the triangle at the level of the cruciate interfrontal bristles obviously wider than from the triangle to an eye opposite that point; both mid and hind femora with fine hairs on the ventral surface toward the base; hind tibia with two posterodorsal bristles, and ventrally with a row of three to five anteroventral bristles, the longest of which are only slightly longer than the diameter of the tibia, but without posteroventral bristles.

*Ophyra villosa* Aldrich may be a synonym. The type and paratype of *villosa,* and another specimen from the type locality, all males, have been compared in detail with European material of *capensis,* and I can find no differences on which to separate them. Some might be found in the characters of the female sex, and until these are known, I do not care to state the synonymy definitely.

**Ophyra obscurifrons,** new species

Virtually identical with *O. capensis,* under which it had previously been determined, but distinguished as follows:

Male: parafrontal and parafacial dull or only subshining, not smooth and polished, but entirely gray to brownish pollinose, appearing under high magnification as if covered with a short, fine nap.

Female: Like the male, but the parafrontal viewed in some lights seems rather shining and must be viewed from different angles to be sure that it is entirely pollinose; frontal triangle long and broad, of approximately the same proportion as *capensis*, differing in having the entire surface covered with the same minute brownish nap as the parafrontal, and thus dull or only subshining instead of smooth and polished.

Holotype, male, Tsinan, Shantung, China, May 3, 1922 (A. P. Jacot). Type No. 58675 in the U. S. National Museum. Allotype, Ningpo, China, June 14, 1925 (J. T. Chu). Paratypes, four males, Tsinan, April 13 and 21, May 26, and June 9, 1922 (Jacot); one male, Ningpo, June 22, 1925 (H. A. Jaynes); one male, Suifu, Szechuen, China (D. C. Graham); one male, Kuanshien, Szechuen, China, June 1-14, 1930 (Graham); one male, Okinawa, June 23, 1945 (F. N. Young). Type series in the U. S. National Museum.

All other species of typical *Ophyra* known to me have the parafrontal, the upper third to half of the parafacial, and the frontal triangle in the female, glabrous and highly polished. Only the species formerly placed in *Australophyra* (= *Peronia*), which are rather atypical *Ophyra*, also have the dull, pollinose parafrontal, parafacial, and frontal triangle.

The published records of *capensis* (usually as *anthrax*) from China may actually refer to *obscurifrons*. Typical *leucostoma* has been found in China, however, and true *capensis* may also occur there in addition to the related *obscurifrons*.

Stein (1907) described *hirtitarsis* from Tibet as having "narrow silver gray dusted orbits," possibly like those of *obscurifrons*. The hind tibia of *hirtitarsis* is quite different, however, the bristles being reduced to one long outer and one shorter inner bristle, compared with the rows of long bristles or setaceous hairs in *obscurifrons*. Further, Stein stated that the acrostichals of *hirtitarsis* are rather strong, and in two rows (like those of *chalcogaster*), whereas in *obscurifrons*, as in *capensis*, the notum is thickly and uniformly covered with fine hairs, and the acrostichal bristles are scarcely distinguishable.

**Ophyra chalcogaster** (Wd.)

*Anthomyia chalcogaster* Wiedemann, 1824, Analecta Entom., p. 52; 1830, Auss. Zweifl. Ins. 2: 427 (Java).

The best single character for distinguishing this species from the others with black palpi is that the posterior margin of the eye as viewed in profile is straight or slightly convex (fig. 3), though this may sometimes cause confusion with *leucostoma*. The eye profile is certainly the quickest way to distinguish *chalcogaster* from *nigra* (cf. figs. 2 and 3), and these two are the most commonly confused species in the Pacific area.

The character most frequently mentioned in connection with *chalcogaster*, namely, that the segments of the fore tarsi are whitish apically, especially on the ventral surface, can be a very

misleading character and one which should be minimized as a means of recognition. It is true that specimens of *chalcogaster* often have strong, distinct white spots at the apices of the fore tarsal segments, which can sometimes be seen from above, though more clearly from below. There are many specimens of *chalcogaster,* however, in which these spots are less distinct, in varying degrees, and this variation has undoubtedly given rise to many misidentifications.

A number of specimens have been reared from poultry manure at the University of Hawaii Agricultural Experiment Station, Honolulu, by Yoshinori Tanada.

From the published records, the species is widely distributed throughout the Ethiopian, Oriental and Australian Regions. A large number of specimens are before me from the following:

Oriental Region: Ceylon, India (Goa, Coimbatore, Malabar), Cochin China, Penang, China (Szechuen, Nanking, Zakow, Hong Kong, Chihli), Formosa, Okinawa, Philippine Islands (Manila, Mindanao, Samar), Sumatra, Java.

Australian Region: Hawaiian Islands, Marianas (Guam, Saipan), Palaus, Ponape, Dutch New Guinea, Bismarck Archipelago, Solomons, New Hebrides, New Caledonia, Northern Territory (Darwin, Melville Island), and Queensland (Brisbane, Townsville). Most of the Australian specimens were determined as *nigra* by early authors, and redetermined as *chalcogaster* by Malloch.

# Observations on the Life History of Pycnoscelus surinamensis (Linn.), the Intermediate Host of the Chicken Eyeworm in Hawaii

By CALVIN W. SCHWABE

Department of Zoology, University of Hawaii

*(Presented at the meeting of November 9, 1948)*

## INTRODUCTION

In beginning a study of the life history of *Oxyspirura mansoni* (Cobbold), the eyeworm of chickens in Hawaii, the author was impressed with the virtual lack of information in the literature concerning the life history and habits of its only known intermediate host, the cockroach, *Pycnoscelus surinamensis* (Linn.). Some observations which have been made on the biology of the roach are herein presented.

## SYNONYMY

*Blatta surinamensis* Linn. (1758 and 1767), *Blatta punctata* Eschscholtz (1822), *Panchlora surinamensis* Guer. (1838), *Pycnoscelus obscurus* Scudd. (1862), *Leucophaea surinamensis* Brunn. (1865), *Blatta indica* Fabr., *Blatta melanocephala* Stoll, *Blatta corticum* Serville, *Panchlora celebesa* Walker, *Panchlora submarginata* Walker, *Panchlora occipitalis* Walker.

## DISCUSSION

The Surinam roach is an important insect pest for which no satisfactory biological control yet exists in Hawaii. In certain localities it has become established as a greenhouse pest and has done considerable damage to the bark of roses and lilies. It is also reported to feed upon the roots of the pineapple, the potato tuber, and other plants. It serves as the only known intermediate host of *Oxyspirura mansoni*, a nematode parasite commonly found beneath the nictitating membrane and in the conjunctival sac of domestic fowl and a number of wild birds.

The presence of *Pycnoscelus surinamensis* in the Hawaiian Islands was first reported by Eschscholtz in 1822. Subsequent observations indicate that the roach is widespread, and at the present time it may be found in abundance on Oahu, Kaui, Molokai, Maui, Lanai, Nihoa, Hawaii, Pearl and Hermes Reef, and French Frigate Shoal.

It is thought by some workers to be originally an Oriental species, but today it is considered circumtropical, having been reported from the following localities: Florida, Louisiana, Texas, and Hawaii in the United States; Cuba and Puerto Rico (Rehn, 1903); the Bahama Islands (Morse, 1905, and Hutson, 1938); the Dominican Republic (Caudell, 1914); Trinidad (Bruner, 1906);

Barbados, Martinique, Grenada, St. Vincent, Jamaica, Mexico, Costa Rica, Guiana, and Brazil (North Am. Orthoptera, 1901); Bermuda (Scudder, 1897); Lower Spain, Africa (Senegal), China (Amoy), and the Philippine Islands (North Am. Orthoptera, 1901); Singapore (Ehrhorn, 1916); Java, Sumatra and the Dutch East Indies (Picard, 1929); Japan and Formosa (Kobayashi, 1927); and Australia (Fielding, 1926).

The normal habitat of the roach in Hawaii is in loose, sandy soil, or beneath trash and debris. It is found most commonly in or around chicken batteries and yards, where it subsists chiefly on chicken feces and other organic matter. The soil is literally teeming with the nymphs and adult roachs in such places, and all stages may be readily collected for study. They mostly remain hidden in the soil during the daylight hours, coming out on the surface to feed only at night. The younger nymphs are not nearly so averse to the light as the adults and larger nymphs; in fact, newborn nymphs in the laboratory exhibited a marked positive phototropism during the first several days of life.

When molested in the soil, the nymphs are considerably more active than the adults; all, however, rapidly seek cover. In random collections of adults the females were always found to be more abundant than the males, an observation which verifies the findings of Hebard (1917) and Zappe (1918), neither of whom found a single male in examination of thousands of roaches throughout the United States, Mexico, and the West Indies. Males are quite common here, however, as evidenced by the large number in the Orthoptera collections of the Entomology Department of the University of Hawaii.

The adult female roach is described by Hebard (1917) as follows:

> Form robust, structure rather heavy. Head flattened, eyes well developed. Maxillary palpi short and stout. Pronotum with glabrous surface, showing minute, rather widely spaced pits. Wings transparent except in narrow area of the irregular costal veins and distal portion of anterior field where they are translucent. Styles very short, joints much fused, accuminate tip flattened, dorsal surface weakly convex, ventral surface more strongly convex proximad. This species is easily separated from the other common cockroaches of North America by having the ventral margins of the femora unarmed, or supplied with distal spines. Head shining, blackish-brown; legs brown; tegmina translucent, blackish chestnut brown. Abdomen with dorsal surface dark brown [varies considerably; may be margined with white or dark bands], ventral surface polished, broadly margined with blackish-brown . . . [various shades of brown have been observed]. Pronotum shining, blackish-brown, with marginal traces . . . [buff colored] latero-cephalad.

For field identification, the adult male may be distinguished from the female in that its wing covers completely cover the abdomen, while those of the female do not.

The mode of reproduction of *Pycnoscelus surinamensis* was previously unknown; several contradictory concepts being recorded in the literature, all apparently based on inadequate observations. To help clarify this situation, a large number of adult female

roaches were housed individually in the laboratory and periodically examined several times a day. The resultant observations coupled with those made in the normal habitat of the roach are herein presented.

The female Surinam roach forms an egg case about the individual eggs. The ootheca is carried internally during the period of gestation and is deposited or carried externally only under such unusual conditions as are outlined below. Normally reproduction is ovoviviparous, the nymphs hatching within the body of the female. Gravid females have on occasions, however, been observed in the soil with egg cases protruding from the ovipositor. Deposition of the ootheca may also be induced in the laboratory in some instances by excitation of the female. E. W. French reports (personal communication) that one small female deposited an egg case while in confinement and twenty-five days later deposited another. No egg cases thus obtained hatched under laboratory conditions, verifying the results of similar attempts by Zappe (1918).

Birth of living young has been observed a number of times by the author, usually at night or when the gravid female was kept in the darkness. It is accompanied by extreme nervousness on the part of the female, which becomes very excited, strains and distends her ovipositor enormously in attempting to expel the new born nymphs and the remainder of the egg case. She will frequently double up and drag the tip of the abdomen. They have been observed to grasp fragments of the ootheca with the hind limbs to facilitate extrusion. The size of broods born in the laboratory varied from thirty to thirty-six nymphs. On one occasion thirty-six hours elapsed between the birth of the first and last nymphs of a brood.

In *P. surinamensis* the egg case lies in the body of the female with the double row of embryos in a horizontal position, in contrast to the vertical position of the egg case of *Periplaneta americana* (Linn.) and other roaches. When accidentally deposited or dissected from the gravid female, the egg case is light cream in color, turning buff to tan upon exposure to the air. Those observed have not hardened, unlike those of oviparous roaches, and are therefore very susceptible to damage.

The ootheca consists of two rows of alternately spaced segments, each housing an embryonated egg. Between thirty and thirty-six segments have been counted on specimens studied, a range which corresponds to the number of nymphs per brood born in the laboratory. The egg case measures approximately 9 mm. by 3.5 mm. by 2.5 mm. Embryos dissected from the eggs were well advanced in development and their appearance was much the same as that of the new born nymphs described below.

The nymphs when born are a translucent white with orange-brown mandibles and spines, and are approximately 4.5 mm. in length. The head measures 1.1 mm. wide and 0.6 mm. long and the eye spots are darker than the remainder of the head. The

exoskeleton begins to harden upon exposure to the air and in 5 to 6 hours it is a glossy mahogany brown, the ventral surface and legs still remaining translucent. The fragments of the ootheca extruded by the female are usually devoured by the nymphs soon after birth.

SUMMARY

Observations on the habitat, mode of reproduction, and habits of *Pycnoscelus surinamensis*, the intermediate host of the chicken eyeworm in Hawaii, have been presented, with notes on the appearance of the egg case and the new born nymphs.

## BIBLIOGRAPHY

Bruner, L. 1906. Report on the Orthoptera of Trinidad, West Indies. Jour. N. Y. Ent. Soc. **14**: 141.

Caudell, A. N. 1914. Orthoptera of Yale-Dominican Expedition of 1913. Proc. U. S. Nat. Mus. **47**: 491.

Ehrhorn, E. M. 1916. Hawaiian Forester and Agriculturist, **13**(2) : 44.

Eschscholtz, J. F. 1822. Entomographien, 1, Lieferung, 128, iii pp., 11 col. pls., 23½ cm., Berlin, G. Reimer. (*fide* Illingworth, J. F. 1923.)

Fielding, J. W. 1926. Preliminary note on the transmission of the eyeworm of Australian poultry. Austral. Jour. Expt. Biol. and Med. Sci. **3** : 225-232.

Hebard, M. 1917. Blattidae of North America, pp. 193 and 269. (*fide* Zappe, 1918.)

Hutson, L. R. 1938. Some observations on Manson's eyeworm of poultry in Antigua, B. W. I. and a suggested method of control. Trop. Agr. (Trinidad), **15**(3) : 66-68.

——— Ms. Miscellaneous veterinary research in Antigua, B. W. I. Studies on Manson's eyeworm of poultry. Unpublished thesis : University of Toronto, 1943, pp. 1-32, 7 pls.

Illingworth, J. F. 1923. Early references to Hawaiian Entomology. Bernice P. Bishop Museum Bul. **2**, pp. 1-63.

Kobayashi, H. 1927. On the life history of the *Oxyspirura mansoni* and pathological changes in the conjunctiva and the ductus lacrymalis caused by the worm. Jap. Path. Soc. Trans., **17** : 239-242.

Lucker, J. T. 1941. Climate in relation to worm parasites of livestock. U. S. Dept. Agr. Yearbook, 1941 : 517-527.

Morse, A. P. 1905. Some Bahama Orthoptera. Psyche, **12**: 19.

Pemberton, C. E. and F. X. Williams. 1938. Some insect and other animal pests in Hawaii not under satisfactory biological control. Hawaii. Planters' Rec. **42**: 215.

Picard, W. K. 1929. In Ned. Indie voorkomende Pluimveeziekten. (English summary.) Nederland. Indische Blad. Diergeneesk., **41**(1) : 42-48.

Rehn, J. A. G. 1903. Studies in American Orthoptera. Trans. Amer. Ent. Soc., **24**: 284.

——— 1904. Studies in Old World Forficulids or earwigs, and Blattids or cockroaches. Proc. U. S. Nat. Mus., **27**: 558.

Scudder, S. H. 1897. Psyche, **8**: 43 (*fide* Zappe, 1918).

——— 1901. Alphabetical Index to North American Orthoptera . . . Pap. Boston Soc., **6**, pp. vi+436. Pp. 47, 157, 239, 280 (*fide* Zappe, 1918).

Zappe, M. P. 1918. A cockroach pest of greenhouses. Rep. State. Ent. Conn. Bull. **203**. 1917 : 302-313.

——— 1919. On the life history of *P. surinamensis* (Linn.). Ibid. **211**. 1918 : 311-313.

Zimmerman, E. C. 1948. Insects of Hawaii, **2** : 94-95; fig. 49. Univ. Hawaii Press, Honolulu.

# The Genus Spathomeles Gerstaecker, with the Description of a New Species from Borneo (Coleoptera: Endomychidae)

By H. F. STROHECKER
University of Miami

*(Presented by Mr. Zimmerman at the meeting of June 14, 1948)*

Among a lot of Endomychidae submitted to me for study by Mr. Elwood Zimmerman of the Bernice P. Bishop Museum is a specimen representing an undescribed species of *Spathomeles*. In describing this form I have thought the occasion opportune for presenting a modern synopsis of the genus. The species are not numerous nor is identification difficult but a concise review of the genus will bring together several isolated descriptions.

The genera *Amphisternus* Germar and *Spathomeles* Gerstaecker are the most highly derived of the Eumorphinae, the latter especially showing very strong sexual differentiation. Both these genera agree in having the mesosternum transverse and the metasternum tumid on each side, although this latter feature is variable from species to species. *Spathomeles* differs from *Amphisternus* in having the apex of the prosternal process entire (forked in *Amphisternus*), and in the chisel-shaped apex of the mandible (minutely bifid in *Amphisternus*). In both genera the less derived species have a muricate, unpunctured and opaque or glossy surface; the more highly derived species have the surface shining and punctured. In each genus there are species intermediate between these two conditions, e.g. *S. elegans* Gorham, in which the pronotum is finely muricate, the elytra shining and punctured.

With the exception of *S. bonthainicus* Heller, of which I have seen no specimens, I have studied the taxonomy by use of several structural features, including the aedeagus. This last structure, while it shows marked specific differences, is not necessary for identification. In fact, external features may exhibit sharper divergence. I have, nevertheless, included outline drawings of the aedeagi because of the unusual, even gargantuan, development of this organ.

The order in which the species appear in the key is merely one of convenience; the subsequent treatment gives the apparent degree of derivation.

## GENUS SPATHOMELES GERSTAECKER

**Spathomeles** Gerst. 1857. Archiv. Naturgesch. 23: 218

*Cacodaemon* Thomson 1857 (in part). Archives Entomol. 1: 154.
*Rachidophorus* Guérin 1857 (in part). Archives Entomol. 1: 581.
Genotype: *Spathomeles anaglyptus* Gerstaecker.

KEY TO THE SPECIES

1. Pronotum without evident punctures, muricate ..... 2.
   Pronotum punctured, shining, with discal impressions ..... 4.
2(1). Pronotum with discal impressions ..... **elegans** Gorham (p. 440)
   Pronotum without discal impressions, its surface even ..... 3.
3(2). Elytra with weal-like yellow spots ..... **turritus** Gerstaecker (p. 438)
   Elytra with a reddish reticulum ..... **retiarius** sp. n. (p. 438)
4(1). Pre-apical elytral marking a transverse, serrate band ..... 5.
   Pre-apical elytral marking a rounded spot ..... 6.
5(4). Metasternum with a strigose pit at middle of front ..... **decoratus** Gerstaecker (p. 441)
   Metasternum without distinct median pit ..... **dohrnii** Gerstaecker (p. 440)
6(4). Middle elytral spot weal-like or moderately tumid ..... 7.
   Middle elytral spot on a high, conical elevation ..... **darwinista** Dohrn (p. 442)
7(6). Base of hind tibia of male with a strong tooth ..... **anaglyptus** Gerstaecker (p. 442)
   Hind tibia of male without tooth ..... **bonthainicus** Heller (p. 440)

**Spathomeles retiarius** sp. n. (Figs. 1, 2).

Smaller than any hitherto described species and very different in color pattern. Instead of the tumid, yellow spots of other species the elytral markings of *retiarius* consist of a reticulum of reddish color not at all raised above the elytral surface, and not very sharply contrasted with the ground color but nevertheless distinct. General color blackish-brown with violaceous reflections, surface muricate, unpunctured, softly glossy. Head rugose between the antennal bases and with a broad impression on each side. Antennae slender, third joint about half as long again as fourth, club very large and strongly flattened. Pronotum decidedly transverse, its front angles produced and acutely rounded, its hind angles acutely but briefly produced. Basal transverse stria deep, lateral striae short and feeble. Elytra short and highly convex, apices subtruncate. Each elytron is elevated before its middle into a high spine. This spine is very broad at its base, suddenly narrowed at mid-height and there bent abruptly backward and inward. Femora strongly clavate. Tibiae, especially the front ones, curved and with a dense tuft of golden hairs at apex. The middle tibia bears a minute tubercle on its inner face at distal two-thirds of length. Prosternal process narrow between the front coxae, considerably prolonged, smooth, narrowly rounded at apex. Metasternum smooth at middle, with a deep fovea on each side near its front margin. Last abdominal sternite sinuately emarginate. Length 8.5 mm.

Type material: one male, holotype, Sandakan, British North Borneo, December, 1926, Pemberton coll.; Bishop Museum collection.

This species is clearly annectant to *Amphisternus* but presents the critical features of *Spathomeles*.

**Spathomeles turritus** Gerstaecker. 1857. Archiv Naturgesch. 23: 220.

*Spathomeles turritus* Gerstaecker. 1858. Monographie der Endomychiden, p. 67.

The male is generally similar in contour to the previous species but the elytral spines are erect, reflexed slightly at their tips. Pronotum without discal impressions, its surface finely muricate, its

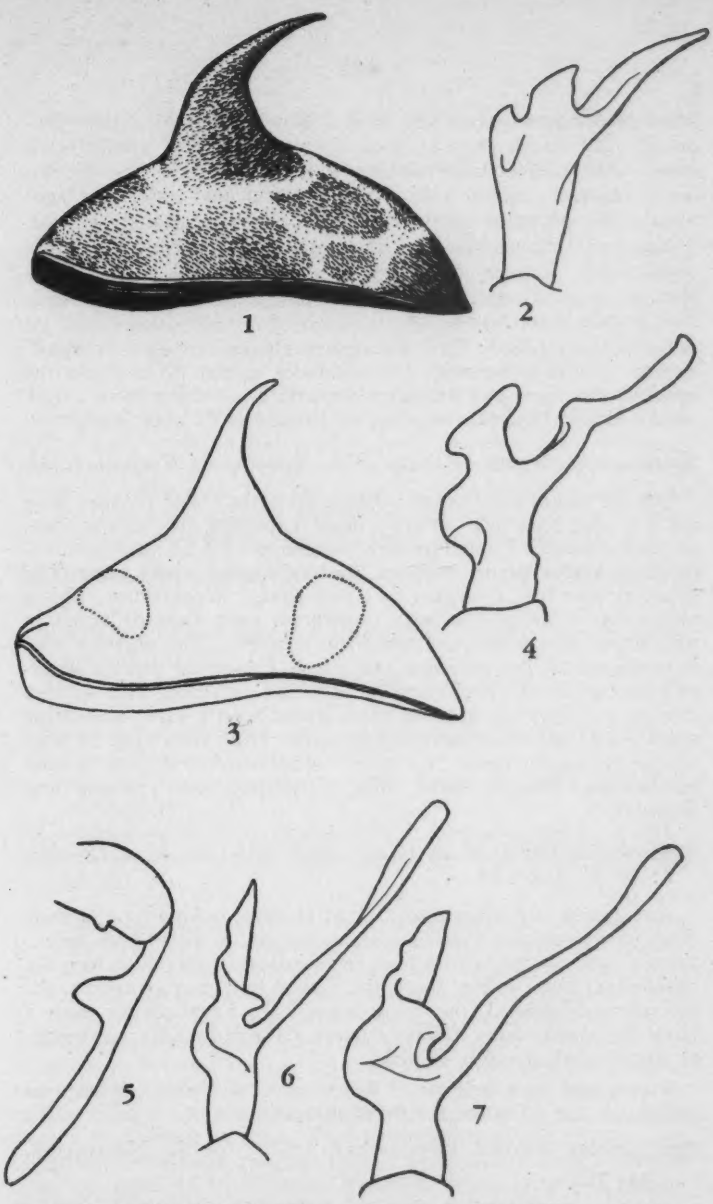



Figure 1. **Spathomeles retiarius** sp. n.: left elytron of male (type), side view.
Figure 2. **Spathomeles retiarius** sp. n.: aedeagus of male (type).
Figure 3. **Spathomeles turritus** Gerstaecker: left elytron of male, side view.
Figure 4. **Spathomeles elegans** Gorham: aedeagus of male.
Figure 5. **Spathomeles elegans** Gorham: hind tibia of male.
Figure 6. **Spathomeles decoratus** Gerstaecker: aedeagus of male.
Figure 7. **Spathomeles anaglyptus** Gerstaecker: aedeagus of male.

front angles acutely rounded, hind angles briefly and acutely produced. The elytra (fig. 3) show feeble punctures; wholly black except that each elytron has two weal-like yellow spots, the anterior obliquely placed behind the humerus and externally acuminate, the posterior transversely oval. Femora strongly clavate. Tibiae gently curved, the hind tibia with a low, blunt tooth on inner distal third. Prosternal process a little expanded at tip, metasternum as in *retiarius*. Length 9.5-10 mm. Reported from Penang. The female is unknown.

Frivaldszky (1883: 126) has reported from Borneo a "variety" *dispar*. The only remark of Frivaldszky is that *dispar* lacks the basal elytral spot, and inasmuch as *turritus* does not have a spot on the elytral base the meaning of Frivaldszky's note is obscure.

**Spathomeles elegans** Gorham 1873. Endomycici Recitati, p. 32.

The following description is based upon the male; females have not yet been reported. Entirely black, excepting two yellow spots on each elytron. Pronotum with surface alutaceous, unpunctured, its front angles bluntly rounded, its hind angles briefly acute. The pronotal disc has a median and two lateral impressions. Elytra moderately shining, distinctly punctured, each elevated at about mid-length into a low, subspiniform tubercle. The anterior spot is posthumeral, the posterior pre-apical. Prosternal process longitudinally grooved. Metasternum as in the preceding two species. Femora strongly clavate, the hind femur with a high, transverse ridge on its posterior surface near apex. Hind tibia (fig. 5) with a large, triangular flange near base. Last abdominal sternite broadly tuberculate. Length 11-12 mm. Reported from Penang and Sumatra.

**Spathomeles bonthainicus** Heller 1898. Abhandl. Mus. Dresden 7: 39; pl. 3, fig. 13.

Apparently still known only from Heller's unique type, a male from Mt. Bonthain, Celebes. Black, the elytra with bluish reflections. Each elytron with a low, subspiniform tubercle before the middle and three yellow spots, the first at base near scutellum, the second post-humeral, the third pre-apical. Front femur with a blunt tooth near base. Tibiae curved, the middle tibia subdentate at apical third. Length 11 mm.

I have seen no specimens of this species but Heller's description and figure are adequate for its identification.

**Spathomeles dohrnii** Gerstaecker 1857. Archiv Naturgesch. 23: 219.

*Spathomeles dohrnii* Gerstaecker 1858. Monographie der Endomychiden, p. 64.

*Spathomeles dohrni* Csiki 1910 (Junk-Schenkling). Cat. Coleopt. pars 12: 18.

*Eumorphus quadrisignatus* Guérin 1857. Archives Entomol. **1**: 257, pl. 13, fig. 12.

*Rachidophorus quadrisignatus* Guérin 1858. Revue et Mag. Zool. (2), **10**: 61.

The most distinctive features of this species are the elytral markings, which consist of an irregular spot at the base and two sinuous or serrate, transverse bands of reddish-yellow color. The second or posthumeral is connected at its inner end with the outer side of the basal spot. Head very thickly punctured between the eyes. Pronotum shining, densely punctured, with a median depression on each side of which is a rounded impression. Front angles obtuse, hind angles slightly acute. Elytra long-oval, blue-black, densely punctate. Prosternal process broad, rough. Metasternum with a deep fovea on each side in front; between these the metasternum has a shallow, roughened impression. The sexes are alike except that the male has the front femur toothed at base, each elytron with a low tubercle and the middle tibia angulately widened at its distal two-thirds. Reported from Sumatra and Java.

**Spathomeles decoratus** Gerstaecker 1857. Archiv Naturgesch. **23**: 31.

*Spathomeles decoratus* Gerstaecker 1858. Monographie der Endomychiden, p. 66.

*Spathomeles ornatus* Gorham 1886. Proc. Zool. Soc. London, p. 155.

*Spathomeles decoratus* var. *ornatus* Gorham 1896. Ann. Mus. Civ. Genova ser. 2, **16**(36): 292.

*Spathomeles decoratus* Arrow 1925. Fauna Br. India: Col. Erotylidae etc., p. 308, fig.

*Cacodaemon hamatus* Thomson 1857. Archives Entom. **1**: 157.

*Rachidophorus latreillei* Guérin 1858. Revue et Mag. Zool. (2) **10**: 61.

Usually each elytron of this species has an oval, yellowish spot near the scutellum, two spots transversely placed before the middle and a pre-apical bar, transversely placed. In some specimens the two middle spots are coalesced (var. *ornatus* Gorham) but this variation is not correlated with geography or ecology so far as known at present. More rarely the pre-apical bar is divided. The inner of the two posthumeral spots encloses a low, subconical elevation. In the male the front femur is toothed near its base, the middle tibia is toothed at its distal third and the hind tibia may have a tooth near its base. The development of the tooth of the hind tibia is variable, ranging from a feeble tubercle to a decided spine. Length 11.5-12.5 mm. Reported from Java (?), Malay Peninsula, Burma and Assam.

In this species and those following the elytral spines of the males are slender, distinctly recurved and longer than in *elegans, dohrnii* and *bonthainicus* but much smaller than in *retiarus* and *turritus*.

**Spathomeles anaglyptus** Gerstaecker 1857. Archiv Naturgesch. **23**: 219 idem. 1858. Monographie der Endomychiden, p. 62, pl. 2, fig. 2.

*Cacodaemon Hopei* Thomson 1857. Archives Entom. **1**: 154.

*Eumorphus Hopei* Guérin 1857. Archives Entom. **1**: 255.

*Rachidophorus Hopei* Guérin 1858. Revue et Mag. Zool. (2) **10**: 59.

The best characters for distinguishing this species have been set forth in the key. The development of the long spine on the hind tibia of the male is apparently constant. The degree of elevation of the middle elytral spot is variable. In specimens from Malacca the elevation is subconical, its highest part about level with the elytral suture when viewed from behind. In the Sumatra specimens at hand this elevation is roundly tumid, in Borneo specimens merely weal-like.

The elytral spines of the male are slender, recurved and subacuminate. The front femur is toothed at base, the front tibia somewhat expanded at apex. The middle tibia is angulately toothed at distal third and clothed there with a dense brush of setae. The metasternum has a very deep, strigose pit at the middle of its front margin. Length 12-13 mm. Range: Malacca, Penang, Sumatra, Java?.

**Spathomeles anaglyptus insuspectus** Gorham.

*Spathomeles insuspectus* Gorham 1873. Endomycici Recitati p. 31.

Differs from nominate *anaglyptus* in the larger size of the elytral spots. The basal and middle spots are approximate and coalesce in some specimens. The middle spot is feebly elevated. Occurs in Borneo.

**Spathomeles darwinista** Dohrn 1873. Stettiner Ent. Zeitung, p. 322.

*Spathomeles pyramidalis* Gorham 1873. Endomycici Recitati, p. 31.

This is clearly the most derivative of the species. In viewing series of *anaglyptus* from various localities and of *darwinista,* one might suppose that a single Rassenkreis was represented but the form of *anaglyptus* occurring in Borneo is less similar to *darwinista* than is nominate *anaglyptus* from farther south. While closely related, *darwinista* differs from *anaglyptus* in several features. The elytral spots are much smaller and the middle spot encloses a high, conical elevation (fig. 9). The elytral spines of the male are more decurved and longer and the hind tibia is feebly toothed or, more often, simple. The front tibia (fig. 11) is very broadly expanded at its apex and deeply excavated on its inner margin. The aedeagus of *darwinista* (fig. 10) shows the greatest degree of development in the genus. The median mesosternal pit is also greatly developed.

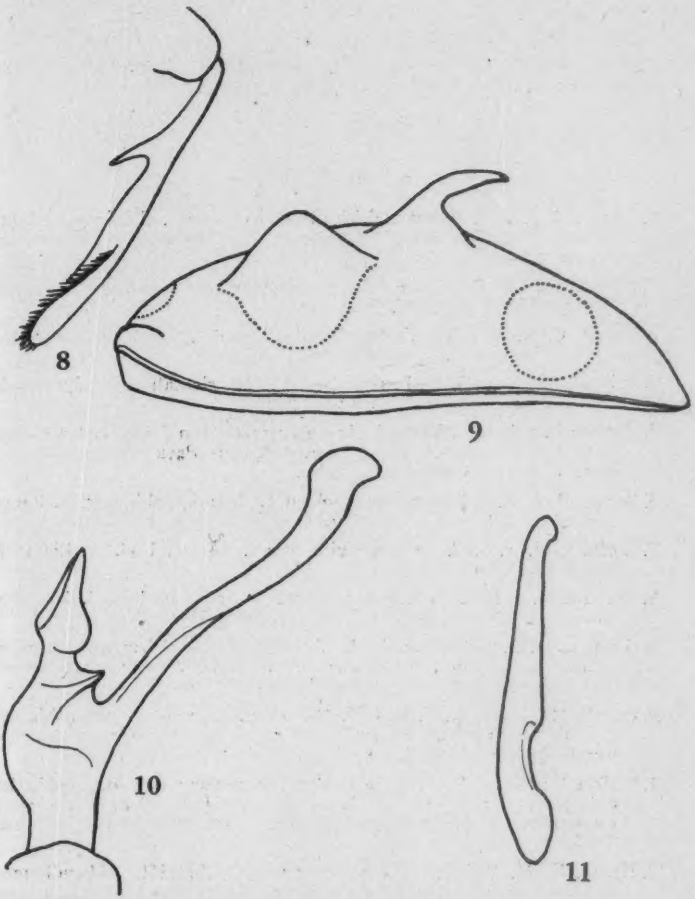



Figure 8. **Spathomeles anaglyptus** Gerstaecker: hind tibia of male.
Figure 9. **Spathomeles darwinista** Dohrn: left elytron of male, side view.
Figure 10. **Spathomeles darwinista** Dohrn: aedeagus of male.
Figure 11. **Spathomeles darwinista** Dohrn: front tibia of male.

Apparently this pit is accessory to the two deep foveae of the mesosternum, which are likely glandular in function. Several collectors have remarked that various species of Oriental Endomychidae exude strong-smelling fluids when disturbed.

The length of the present species is 12-13 mm. It has been reported from the Philippines. More definite are the labels on four of the specimens at hand: "Surigao, Mindanao."

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## BIBLIOGRAPHY


1. Arrow, G. J. 1925. Fauna British India. Coleoptera. Clavicornia. Languriidae, Erotylidae and Endomychidae. xv+416 pp., 1 pl. Taylor and Francis, London.
2. Csiki, E. 1910. (ed. Schenkling) Coleopterorum Catalogus, pars 12, Endomychidae, 68 pp. W. Junk, Berlin.
3. Dohrn, C. A. 1873. Exotisches 18. Spathomeles. Stettiner Entomologische Zeitung (1873): 322-323.
4. Frivaldszky, J. 1883. Endomychidae in Asia orientali a J. Xántus collectae. Természetrajzi Füzetek 6: 123-133, pl.
5. Gerstaecker, A. 1857. Versuch einer systematischen Auseinandersetzung Gattungen Eumorphus Web. und Endomychus Payk. Wiegmann's Archiv für Naturgeschichte 23: 221-243.
6. Gerstaecker, A. 1858. Entomographien 1. Monographie der Endomychiden. xiv+433 pp., 3 pls. Wilhelm Engelmann, Leipzig.
7. Gorham, H. S. 1873. Endomycici Recitati. 64 pp., 1 pl. Williams & Norgate, London.
8. Gorham, H. S. 1886. On new genera and species of Endomychidae. Proceedings Zoological Society London (1886): 154-163, pl. 17.
9. Gorham, H. S. 1896. Viaggio di Leonardo Fea in Birmania e regioni vicine. Languriidae, Erotylidae and Endomychidae. Annali Museo Civico Storia Naturale Genova (2), 16 (36): 257-302.
10. Guérin-Méneville, M. F. E. 1857. Matériaux pour une monographie des Coléoptères du groupe des Eumorphides et plus spécialement du genre Eumorphus. Archives Entomologiques 1: 237-280, pl. 13.
11. Guérin-Méneville, M. F. E. 1858. Matériaux pour une monographie des Coléoptères du groupe des Eumorphides, et spécialement du genre Eumorphus. Revue et Magasin Zoologie Pure et Appliquée (2), 10: 59-63.
12. Heller, K. M. 1898(99). Neue Käfer von Celebes III. Abhandlungen und Berichte Königlischen Zoologischen Anthropologischen Ethnographischen Museums zu Dresden 7: 39-40.
13. Thomson, J. 1857. Description d'un genre nouveau de la famille des Eumorphides et de plusieurs espèces qui rentrent dans cette division. Archives Entomologiques 1: 153-157.

# Synonymy of Hypocryphalus mangiferae (Stebbing) and its Occurrence in Hawaii (Coleoptera: Scolytidae)

By O. H. SWEZEY

*(Presented at the meeting of May 10, 1948)*

Among specimens of Scolytidae sent to the Division of Insect Identification, U. S. Bureau of Entomology and Plant Quarantine, in February and March, and studied by Dr. W. H. Anderson, were some beetles which he determined as *Hypocryphalus mangiferae* (Stebbing). The specimens of this species studied by Dr. Anderson at that time were six reared from mango scions at the Foster Gardens, Honolulu, September 19, 1931, by Dr. H. L. Lyon, and four which were collected at light in Manoa Valley, Oahu, February 12, 1940, by E. M. Ehrhorn. The identification was by comparison with specimens of *mangiferae* already present in the U. S. National Museum collection. I had previously tentatively determined these, and so labelled them as *Hypothenemus griseus* Blackburn (1885), a species described from a single specimen on poppy, and apparently never taken since. The later records of *H. griseus* noted by me (Proc. Hawaiian Ent. Soc., 11: 119, lines 8-10) should all be deleted, since they really refer to *H. mangiferae*.

On my mentioning the difficulty of finding *mangiferae* in the literature, Dr. Anderson kindly supplied the following synonymy and bibliography:

*Hypothenemus* sp., Stebbing, Indian Museum Notes **6**: 68, 1903 (India).

*Cryphalus* (*Hypothenemus*) *mangiferae* n. sp., Stebbing, Indian Forest Insects: 542-543, 1914 (India).

*Dacryphalus* (*Cryphalus*) *mangiferae* (Stebbing). Hopkins, Bull. Ent. Research, **18**: 28, 1927 (Apia, Samoa).

*Hypocryphalus mangiferae* n. sp., Eggers, Inst. Biol. (Sao Paulo) Arquivos, **1**: 85, 1928 (Brazil).

*Cryphalus* (*Hypocryphalus*) *mangiferae* Stebbing. Beeson, Insects of Samoa, **4**: 226, 1929 (Apia, Samoa).

*Hypocryphalus mangiferae* (Stebbing). Eggers, Wiener Ent. Zeit. **47**: 185, 1931.

*Hypocryphalus mangiferae* (Stebbing). Beeson, Jour. Fed. Malay States, **18**: 288, 1938.

*Hypocryphalus mangiferae* (Stebbing). Beeson, B. P. Bishop Mus., Occ. Papers, **15**, no. 18: 198, 1940 (Mangareva Id.).

There are no records of the capture of *mangiferae* in Hawaii aside from those mentioned above, so it is not known if the species is well established and widespread; it seems that if it were, more of the local entomologists would have collected it. In India it is recorded as boring into the living mango twigs, and hence it is rated as injurious. It would be well to be on the lookout for its presence in mango trees in Hawaii.

It is widely distributed as is seen from the above bibliography: India, Samoa, Mangareva Island, Brazil and now Hawaii.

Note: In a letter Dr. Anderson has expressed his belief that *Ericryphalus henshawi* Hopkins is a synonym of *Ericryphalus sylvicola* (Perkins); and that *Cryphalus swezeyi* Schedl belongs in the genus *Ericryphalus*.

## War-Time Dispersal of Pacific Island Nysius (Hemiptera: Lygaeidae)

By ROBERT L. USINGER
University of California, Berkeley
*(Presented by Mr. Zimmerman at the meeting of May 10, 1948)*

Species of the genus *Nysius* occur on most of the islands of the world, the most noteworthy exceptions being the islands of central and southeastern Polynesia. A high degree of endemicity is exhibited by these species, even on low islands such as Jarvis Island, Wake Island, and the leeward islands of the Hawaiian archipelago; therefore, it would appear that the group is readily dispersable, highly adaptable, and quite variable.

Attention was called to an apparently immigrant species, *Nysius caledoniae* Distant, on Guam (Usinger, B. P. Bishop Mus. Bull. **189**: 28, 1946). World War II greatly increased the chances of dispersal of Pacific Island insects. As might be expected, several species of *Nysius* were distributed during this period. New records which have come to my attention are recorded at this time as an aid to future students of insular speciation.

1. *Nysius terrestris* Usinger, 1942. Hawaiian Islands. New record: Johnston Island, May 1, 1946 (N. L. H. Krauss) sent for determination by E. C. Zimmerman.
2. *Nysius pulchellus* Stål, 1859. Guam. New record: Eniwetok Atoll, May 13, 1946, on *Portulaca* (R. G. Oakley), determined by R. I. Sailer.
3. *Nysius picipes* Usinger, 1937. Wake Island. New records: Engebi Island, Aomon and Japtan Island, Eniwetok Atoll, May 15 to 18, 1946 (R. G. Oakley and Henry Townes), sent for determination by R. I. Sailer.

## Notes on Parasites of Agonoxena argaula Meyrick

By R. H. VAN ZWALUWENBURG
*(Presented at the meeting of October 11, 1948)*

The finding of *Agonoxena argaula* Meyrick attacking various palms in Honolulu late in June, 1948, by C. E. Pemberton and the writer, adds another to the list of insects attacking coconut palms in Hawaii. This agonoxenid moth is a native of Fiji, Samoa and the Ellice Islands, and was recently found to be established on Palmyra Island. It is believed to have been present on Oahu for at least two years, but escaped attention because of confusion of its damage with that caused by the native pyralid, *Omiodes blackburni* (Butler). The *Agonoxena* larva is greenish yellow and feeds on the epidermis of the under leaf-surface beneath a fine web; it does

not tie the edges of the leaf together as *Omiodes* does. At first the feeding scar is confined to a long, narrow area, but later this is expanded into an irregular blotch. Pupation takes place beneath a tight oval web, usually on the underside of the leaf. The egg of this moth is not known.

J. S. Rosa and the writer soon found that *Agonoxena* is attacked by two parasites already known here: *Zaleptopygus* (*Cremastus*) *flavo-orbitalis* (Cameron) and *Brachymeria polynesialis* (Cameron). The combined parasitism of these species is usually high, and it seems improbable that *Agonoxena* will ever become a serious pest here. However, the accumulated feeding over a period of some two years, which is about the length of time any one coconut frond persists on the tree, gives the trees an unsightly appearance, even though the *Agonoxena* population is never high at any one time.

Through the cooperation of Blair Menardi of Tutuila, American Samoa, a shipment of parasitized *Agonoxena* material was made to Honolulu in August, 1948. From this were reared one individual of *Apanteles agonoxenae* Fullaway, and four adults of a *Brachymeria* which D. T. Fullaway, who identified all the parasites from the Samoan material, reports to be an undescribed species. The following refers to this new *Brachymeria,* which was bred in the laboratory by Mr. Rosa and the writer.

Only one female survived from the Samoan material; confined for a day or two with males from the same source, she lived in the laboratory for 54 days. Prepupae or freshly formed pupae of *Agonoxena* were exposed to the female (the first when she was four days old) every few days, as field material was available. During her life this female produced seven males and nine females. Her first progeny was a male which issued 14 days after she was observed (when seven days old) to oviposit in a host pupa. The average time between oviposition and emergence of the adult progeny was between 14 and 15 days, with evidence that males require slightly less time for development than females. The average mean temperature during the period involved was 79.1 degrees F. A second generation male *Brachymeria* survived 37 days in the laboratory. Eleven *Brachymeria* (eight females and three males) reared from the original Samoan female were released at Kaalawai, Honolulu, August 23 and September 8, 1948. No field recoveries of the parasite have yet been made.

# A New Dynatopechus Weevil Injuring Lima Beans in Hawaii (Coleoptera: Curculionidae: Cossoninae)

By ELWOOD C. ZIMMERMAN
EXPERIMENT STATION, H.S.P.A.

## With a Description of the Larva

By W. H. ANDERSON
UNITED STATES BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
WASHINGTON, D. C.

*(Presented at the meeting of December 13, 1948)*

## Part I. The Adults

By ELWOOD C. ZIMMERMAN

The peculiar weevil genus *Dynatopechus* was erected by Sir Guy Marshall in 1931 (Insects of Samoa **4**[5]: 325) to receive a new species from Samoa and *Amorphocerus aureopilosus* Fairmaire from Tahiti and Fiji. The genotype, *D. rubronotatus* Marshall, is known only from the unique female holotype (from Apia, Upolu) now in the British Museum. Fairmaire's species is recorded only from the type series described a century ago (Revue et Magasin de Zoologie, p. 73, 1849) from specimens found by Vesco to be rather common in the beans of *Erythrina* in Tahiti, and from a series collected at Oneata, Lau, Fiji, August 18, 1924, from a pod of *Erythrina indica* by E. H. Bryan, Jr. This series was identified from the description by Marshall, and it evidently formed the basis of his Fijian record in his 1931 report. According to a letter from Marshall, Fairmaire's type may have been in the Godeffroy collection in the Hamburg Museum which was destroyed during the war.

In January, 1940, George Callaghan, U. S. Bureau of Entomology and Plant Quarantine, intercepted a species of the genus in a curio containing seeds of *Leucaena glauca* ("koa haole") being mailed from the Honolulu post office. In September, 1940, three examples were intercepted in seeds of *Adenanthera pavonina* by Territorial Board of Agriculture and Forestry quarantine inspectors in a package mailed to Honolulu from Kyoto, Japan. The origin of the seeds is unknown, but they may have been sent from the tropical Pacific to Hawaii by way of Japan. Following the first interception, U. S. Bureau of Entomology and Plant Quarantine inspectors found other curios containing the following seeds infested: *Canavalia* ("mauna loa"), *Mucuna urens, Mucuna gigantea, Dioclea violacea, Coix lacryma-jobi* (Job's tears) and more *Leucaena glauca* seeds. Most or all of the infested curios were made in Honolulu and on the island of Hawaii, but no definite informa-

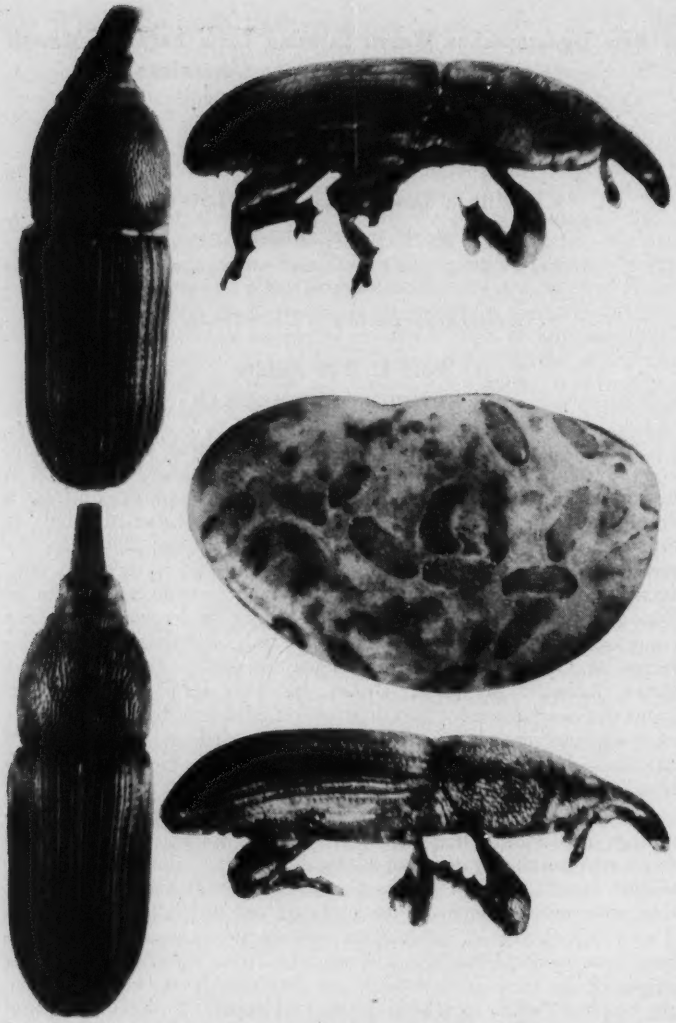

Figure 1.—Photographs of adults of *Dynatopechus* and a lima bean showing pupal cells of *D. calandrodes* Zimmerman. Dorsal and lateral views of *D. aureopilosus* (Fairmaire) at top and *D. calandrodes* Zimmerman at bottom. Each weevil is 4.5 mm. long overall; the bean is 25 mm. long. (Photographs by J. T. Yamamoto.)

tion as to the origin of the infested seeds could be obtained, although it was assumed that they were grown in Hawaii. Special searches were made on Oahu to find the weevils infesting various seeds in the field, but no infestations could be found. In June, 1947, a second species of the genus was intercepted by quarantine inspectors at the Honolulu post office in *Canavalia* seeds in a curio being sent to the Mainland. No records of these interceptions were made in these "Proceedings," for it could not be determined that the weevils were established and breeding in Hawaii, because curios, and possibly bulk seeds, were being imported to Hawaii from Samoa, Tahiti, Fiji and Micronesia by curio manufacturers and travelers.

In the fall of 1948, Mrs. Zimmerman called my attention to several *Dynatopechus* weevils in a green lima bean pod picked in our garden. An inspection revealed that almost every pod of our lima beans which had been broken by the attack of the bean lycaenid butterfly (*Lampides boeticus* [Linnaeus]) contained one to several weevils. Undamaged green pods were not infested. A number of the weevils were placed with some dried lima beans which soon became heavily infested with larvae. A large number of adults were reared in a few weeks. Subsequent inspection showed a heavy infestation of the dried beans hanging on the vines. It appears that as soon as the pods dry and split open, the weevils enter the pods and eat their ways into the beans, where the eggs are deposited. The adult weevils enter the beans by gnawing through the seed scars, or through breaks in the seed coat, and the infestation results in hulls full of frass and evacuated pupal chambers. Large numbers will develop in a single lima bean seed. The seeds are, of course, destroyed.

From information now available, it is known that *Dynatopechus* weevils may develop into pests of economic importance when introduced into new areas. The new species described here has been observed to infest heavily lima beans on the vine and to destroy the seeds, and several generations have been reared on dried lima beans in storage. It would appear advisable, therefore, that the spread of these weevils to new areas be stopped, if possible. A ban on the shipment to the mainland United States of unfumigated leis and other curios containing leguminous seeds is suggested. Also, it is recommended that such seeds being imported to Hawaii from Pacific islands, whether in bulk or in curios, be fumigated or confiscated and destroyed. Although the *Dynatopechus* weevils heretofore have been known only to a few museum workers, and have remained practically unknown in their tropical island haunts, we now know that there are several species in the genus, that they are seed-eaters, and that they are potential pests.

*Dynatopechus* weevils belong to a subfamily whose members characteristically are feeders under dead bark and in dead wood and are useful in returning dead plant material to the soil. *Dynatopechus* has an unusual and unexpected habit for the group. Another

peculiarity is its remarkable similarity to the *Calandra* (*Sitophilus*) grain weevils, with which they may be confused easily unless examined carefully. As a matter of fact, at least one infestation of *Dynatopechus* intercepted in quarantine at Honolulu was determined as *Calandra oryzae* by an entomologist of long experience. Some *Dynatopechus* have red markings on the dorsum quite like those on some *Calandra*, and they are about the same size, coloration and general appearance. This apparent "mimicking" of *Calandra* by *Dynatopechus* is a most interesting phenomenon. Another unusual feature of these weevils is the peculiar sculpture of the elytra which is somewhat like that of *Calandra*, but the punctures are less coarse and the intervals and striae are more distinct. As Marshall noted in his original generic description, and with his characteristic acuteness of observation, the first three striae are carinate on their *outer* edges, whereas the other intervals are carinate on their *inner* edges.

*Calandra* weevils are easily distinguished from *Dynatopechus*, because on *Calandra* the pygidium is exposed and conspicuous from above, and the antennae, which are inserted very close to the eyes, have six-segmented funicles instead of five-segmented ones—to mention only a few of the characters which can be noted easily by those unfamiliar with these weevils.

The description which follows is that of one of the two species of *Dynatopechus* known to be established in Hawaii. New information on the second species (the one heretofore most frequently intercepted in curios in Honolulu) has come to hand while these "Proceedings" were in proof, hence a discussion of that species will be delayed until a second report can be written. It is not *aureopilosus* as determined earlier.

**Dynatopechus calandrodes** Zimmerman, new species (figs. 1, 2, 3).

Derm mostly dulled by reticulation, piceous to black with the appendages more diluted with red; each elytron with a variable, basal, reddish patch across intervals three to six or seven inclusive, and another variable reddish patch at and behind middle extending across intervals three to five inclusive, or only on intervals four and five or extending onto six, these reddish patches commonly connected longitudinally along intervals three and four, and the red color may extend back onto declivity; sides of disc of pronotum usually with variable reddish coloration, but less definite than elytral markings.

*Head* coarsely and densely punctate above, punctures smaller and less dense only on the basal area; interocular area broadly flattened in both sexes, without a median fovea, approximately twice as broad between eyes as breadth of an eye as measured from front, punctures deep, coarse, tending to form a reticulate pattern or, apically in male, tending to be longitudinally confluent with those on base of rostrum; eyes measured from side, slightly longer than distance between their hind margins and pronotum; under-surface punctate and with transverse striae.

*Rostrum*, from front margin of an eye to apex of epistome (not apex of mandibles), two-thirds as long as pronotum in both sexes; longitudinal dorsal contour, as viewed from side, evenly arcuate from top of head to apex, except for the slight flattening at the interocular area; distinctly broader and heavier in male than female; densely set with longitudinally confluent punctures in male from base to apex; female with small punctures beyond antennae and moderately shiny.

*Antennae* with scape distinctly more angulate and strongly clavate in male than female (see drawings); first funicular segment as long as broad, twice as long as two which is transverse, three, four and five each more strongly transverse, five twice as broad as long; club as long as funicular segments two to five inclusive (funicle and club similar to Marshall's figure of *rubronotatus*, but with a small fourth segment to club which is not indicated in Marshall's figure).

*Prothorax* slightly broader than long (34:32 on holotype, 32:29 on allotype), broadest just behind middle; base distinctly sinuous; sides just in front of postero-lateral angles sharply, narrowly incised by the impressed line which extends from sternum, thus the postero-lateral angles sharply tuberculiform (as viewed from above), the development of the protuberance variable, usually more strongly developed on males and rather inconspicuous on some females; sides evenly arcuate to the strongly, sharply incised subapical constriction, the constriction continued across disc as an impressed line, the area in front of the constriction collar-like; longitudinal dorsal contour evenly arcuate from base to subapical constriction; densely, coarsely, subconfluently and confluently punctured, intervals narrower than punctures and forming a reticulate pattern, some examples with a vague indication of a median line; punctures bearing short, golden, prostrate setae which are not very conspicuous.

*Elytra* subparallel-sided in basal two-thirds, jointly rounded at apex, not quite twice as long as broad, a little more than twice as long as prothorax (measured from side), longitudinal dorsal outline discontinuous with that of pronotum; intervals flat on disc (except for carinate edges) and there wider than striae, shallowly punctate, the punctures bearing mostly rather inconspicuous, prostrate, golden setae; striae with chain-like punctures bearing inconspicuous, golden setae; intervals and striae blending in the lateral and caudal areas with the carinate edges of the intervals alone appearing as cariniform intervals and the punctate part of the intervals together with the striae appearing as broad striae; carinae of intervals strongly developed throughout and especially elevated and prominent on the declivity.

*Legs* coarsely, densely punctate, punctures longitudinally confluent on tibiae and apically on femora; femora sexually dimorphic, shaped as illustrated.

*Underside* densely and rather coarsely punctured throughout; prosternum with subapical constriction deeply impressed throughout, intercoxal process about eight-tenths as broad as a fore coxa, distance from fore coxal cavity to fore margin three times as long as distance from hind margin of fore coxal cavity to hind margin of prosternum; an impressed line across prosternum just behind coxae to dorsum; metasternum with shortest distance between mid and hind coxae twice as great as greatest antero-postero chord of a metacoxa; venter with disc of first segment flattened in female, but broadly, shallowly concave in male, segments three and four with numerous punctures across entire breadths, male with disc of segment five differentiated in elevation from sides and with the setae of the punctures modified into longer, fine, erect, conspicuous hairs.

Length: 2.75-3.5 mm.; breadth: 1.0-1.25 mm.

Holotype male, allotype female and a long series of paratypes reared by me from lima bean seeds (*Phaseolus limensis*) taken in my garden at Manoa Valley, Honolulu, in October, 1948. The holotype and allotype are in the Bishop Museum, Honolulu.

Sir Guy Marshall has kindly compared specimens of this new species with his unique female type of *D. rubronotatus*, and he reports that his species differs by its having the "rostrum shorter, stouter and less curved; eyes rather less convex, punctures on the vertex much finer; prothorax subconical, being widest quite close

to the base and much more rapidly narrowed in front, the apical constriction markedly shallower, punctures on the disk small and separated (not confluent), as also are the punctures on the head and rostrum; elytra with the punctures duplicated on the basal half of interval 2 and the basal fourth of interval 3."

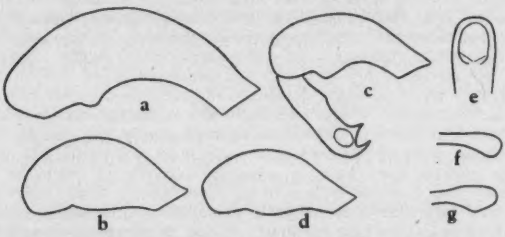


Figure 2.—Features of *Dynatopechus*. **a**, fore femur of male *aureopilosus* (Fairmaire); **b**, the same, female; **c**, fore femur and tibia of male *D. calandrodes* Zimmerman (the angle between uncus and mucron of tibia varies somewhat according to angle of view); **d**, fore femur of female *D. calandrodes;* **e**, apical part of aedeagus of *D. calandrodes* (apical setae omitted); **f**, antennal scape of female *D. calandrodes*, and **g**, the same of the male.

The new species appears to be closely allied to *aureopilosus*, and it closely resembles that species. It is, however, obviously a more coarsely punctured species than is *aureopilosus*, and a comparison of the sculpture of the pronotum alone provides an easy and quick way of separating the two species. The longitudinal dorsal contour of pronotum and elytra of *aureopilosus* are more nearly continuous than that of the new species. The pronotum of *aureopilosus* commonly has an impunctate median line, and is reddish with a broad, median, black stripe. The differences in the shapes of the fore femora are indicated by the drawings. The apex of the aedeagus of *aureopilosus* has a small, more heavily sclerotized, triangular point at the middle of the apical rim which is absent in *calandrodes*.

As noted above, I have reared this species through several generations on dried lima beans. No detailed studies have been made on its host range, or on its life history. A few notes, however, have been assembled. The first specimens of the species taken in Honolulu were intercepted on June 19, 1947, by a quarantine inspector who found them infesting *Canavalia* seeds in a curio mailed from the Waikiki post office, Honolulu. I have obtained reproduction in dried seeds of purple hulled cowpea (*Vigna sinensis*) and mung bean (*Phaseolus aureus*). The adults fed on dry, very hard field corn ("Guam" variety), but I observed no reproduction. The mung beans are so small that the larvae fed from the outside of the beans and were found loose in the sample of beans artificially infested. The exact length of the life cycle was not determined, but it is less than six weeks.

## Part II. Description of the Full-grown Larva of Dynatopechus calandrodes Zimmerman

By W. H. ANDERSON

Approximately 3 mm. long; head 0.55 to 0.57 mm. wide. Head free,[1] approximately as broad as long, subcircular, orange-brown, with two narrow but distinct dorsal epicranial non-pigmented stripes which converge posteriorly. Internal epicranial ridge moderately distinct. Anterior ocellus present, small. Accessory sensory appendage of antenna subconical. Frontal suture distinct throughout its length, angulate posteriorly. Endocarina present, slightly less than one-half as long as frons. Frons with four pairs of setae, the setae moderately long, subequal (Fig. B). Epicranium with five dorsal, two lateral and two ventral setae, the dorsal and lateral epicranial setae moderately long, subequal, the ventral setae slightly shorter. Clypeus with setae short, subequal. Anterior margin of labrum smoothly rounded or slightly produced in the middle. Labrum with setae short, subequal, and with three basal sensilla. Labral rods (Fig. E) moderately long, stout, subparallel. Epipharynx with three anterolateral and six anteromedian setae and four median spines. Epipharynx with two groups of sensory pores, each group consisting of four pores, one group in front of the other behind the median spines. Mandible with two apical teeth, without differentiated molar area. Labial palpus (Fig. F) with two articles. Premental sclerite present, with broad posterior median extension. Postmentum with three pairs of setae, the setae of posterior pair separated by a distance subequal to that between those of middle pair. Mala with five ventral and six dorsal setae (Fig. C).

Pronotum (Fig. A) with eleven setae of which ten are moderately long to long, subequal. Thoracic spiracle bicameral, the air tubes subequal in length to diameter of subcircular peritreme. Spiracular area of mesothorax with two setae, one long, the other short. Mesothorax and metathorax with four postdorsal setae, setae 1, 3 and 4 long, 2 short. Pedal area with six setae. Sternum with one pair of elongate setae.

Abdominal spiracles bicameral, the air tubes distinct and annulated, the spiracles oriented so that the air tubes are directed posteriad. Five postdorsal setae present on abdominal segments I to VII, VIII with four, IX with two. Typical abdominal segments with postdorsal setae 1, 3 and 5 long, 2 and 4 short. Seta on pedal area moderately long. Eusternum with the more lateral seta short to very short, the more ventral seta moderately long. Sternellum absent. Anus terminal, not subdorsal. Asperities inconspicuous, short and sparse.

Walls of proventriculus not sclerotized and not set with asperities.

Description based upon larvae collected at Honolulu, October, 1948, in lima bean, E. C. Zimmerman collector. The larvae studied are in the collection of the United States National Museum.

Larvae of *D. calandrodes* are separable from those of the unidentified species of *Dynatopechus* discussed above by Mr. Zimmerman only by careful examination of specimens properly mounted on microscope slides. In larvae of the unidentified species, the setae on frons are obviously shorter (Fig. D), the seta on pedal area of typical abdominal segments is usually distinctly shorter than is the longer seta on pleurum or eusternum of the corresponding segment, and the asperities, particularly on the dorsal folds of the body, are coarser and more numerous. The larvae of the unidentified species studied were collected in leis containing seeds of *Canavalia* sp. from Honolulu, April 7, 1941.

[1] For an explanation of this and other terms used in this description see: Anderson, W. H., "A terminology for the anatomical characters useful in the taxonomy of weevil larvae." Proc. Ent. Soc. Wash., 49: 123-132, 1947.

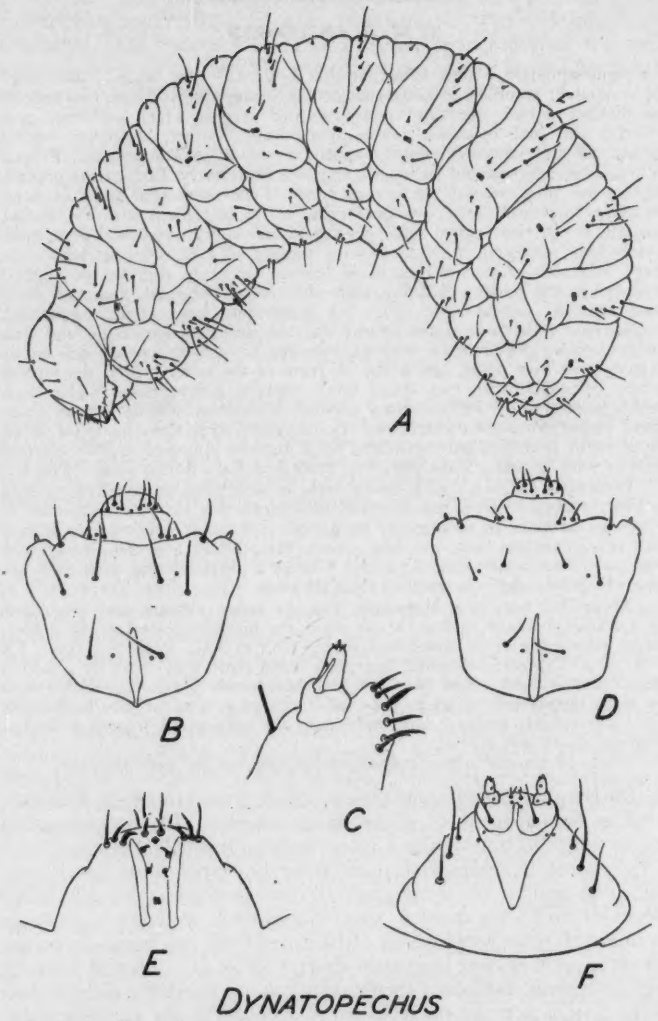


Figure 3.—Features of *Dynatopechus* larvae. A, B, C, E, and F, *Dynatopechus calandrodes* Zimmerman. D, *Dynatopechus,* species not identified. A, larva, lateral view; B, frons; C, mala, dorsal view; D, frons; E, epipharynx; F, labium. (Drawings by W. H. Anderson.)

# NEW INSECT RECORDS FOR THE YEAR 1948

Species marked with an asterisk were reported in the Hawaiian Islands for the first time in 1948, on the dates recorded in the text. Those not so marked were observed here prior to that year, but have only now been identified or recorded. For particulars refer to the pages indicated.

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